C.V.W.

Volume [illegible] November 1953 Number 11

JOURNAL OF

THE AMERICAN GERIATRICS SOCIETY

OFFICIAL JOURNAL OF THE AMERICAN GERIATRICS SOCIETY

PUBLISHED BY THE WILLIAMS & WILKINS CO.
MOUNT ROYAL AND GUILFORD AVENUES, BALTIMORE 2, MARYLAND

ANNUAL MEETING—SAN FRANCISCO—JUNE 17, 18 & 19, 1954

in peripheral vascular disorders

for

more

blood

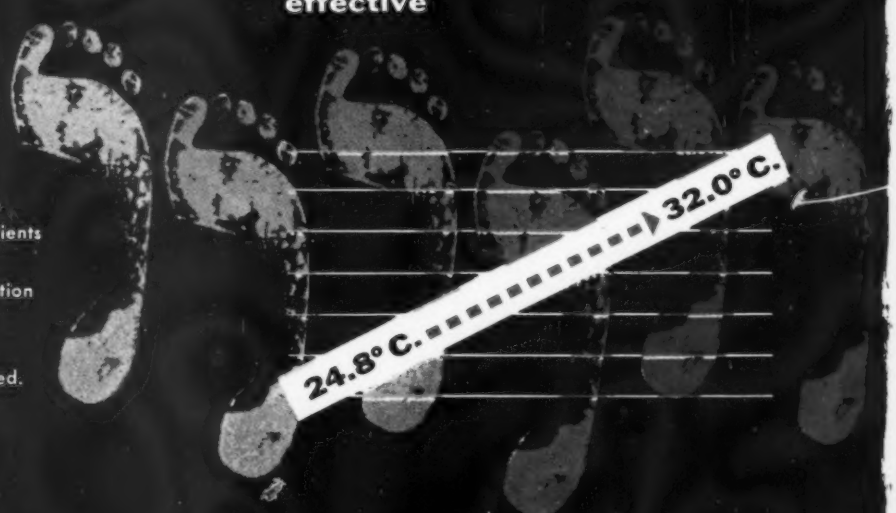
flow . . . **Priscoline®**

hydrochloride
(tolazoline hydrochloride Ciba)

orally and

parenterally

effective



Average rise in skin temperature of toes in 15 patients after a single intravenous injection of Priscoline. (Reedy, W. J.: J. Lab. & Clin. Med. 37:365, 1951.)

Of the peripheral vasodilating agents available "Priscoline, given orally in doses of 0.025 to 0.050 Gm. every three or four hours, appears to be the most practicable for prolonged clinical trial." (Cecil and Loeb: Textbook of Medicine, ed. 8, 1951, p. 1189.)

Ciba Pharmaceutical Products, Inc., Summit, N. J.

Ciba

2/ 1017M

THE JOURNAL OF

The American Geriatrics Society

Official Journal of the American Geriatrics Society

VOLUME I *November, 1953* NUMBER 11

FUNCTIONAL DIGESTIVE DISEASE IN THE AGED*

SARA M. JORDAN, M.D.

Department of Gastroenterology, The Lahey Clinic, Boston, Massachusetts

This talk contains no statistical compilations but is merely a brief discussion of what can be expected of the digestive tract in those of us who are fortunate enough to live to, and beyond the Biblical quota of three score and ten. The work of the digestive organs is accomplished, as we all well know, by good coordination between the autonomic nervous system and the muscular and glandular endowment of the digestive tube from esophagus to anal sphincter. Our influence upon that coordination depends upon two factors: 1) keeping the central nervous system in good order and 2) noninterference with the autonomic nervous system. Because the first factor is important, it is all too common a fault to consider the whole problem a psychosomatic one and to neglect consideration of the second very important factor, that of interference. It is with this second factor that we who are not psychiatrists can do our most effective work.

Functional disturbances of the digestive tract may be classified into 1) those caused entirely by a psychic factor such as emotional trauma or excessive nervous tension; they are transitory, easily identified and cured by relief of the instigating factor, 2) those having a psychic background, but which are no longer transitory but sustained in a groove of poor digestive function with habitual incoordination, and 3) those in which disturbance in coordination is caused by direct interference, through the use of food difficult of digestion, and excesses in smoking, alcohol and the use of laxatives. In the second and third groups the etiologic factors may be intermingled, to the extent that sustained central nervous disturbances may result in interference on the part of the patient by means of laxatives or roughage in food and, conversely, habitual interference may result in nervous disturbances. In my opinion, only in the first group with its transient manifestations of digestive dysfunction is the term psychosomatic exclusively applicable, and in these cases treatment for nervous disturbances alone is effective.

Received for publication July 3, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28–30, 1953.

What are the clinical manifestations of this incoordination which is basic in functional indigestion? Those which involve the muscular part of the digestive tract are in progression from above downward, as follows: globus hystericus, cardiospasm, pylorospasm, gastric atony, small-intestinal hypermotility or stasis, colonic spasm or atony, and anal spasm or atony. Secretory dysfunctions as we know them clinically are manifested in the excessive mucus regurgitated in cardiospasm or passed with defecation in colonic disturbances, and excessive, decreased or absent hydrochloric acid and pepsin.

Relation to age

It might be suspected that atony rather than spasm would prevail in the digestive tract of the aged. Seventy years of muscular work should perhaps result in less contractile power. Generally speaking, however, this is not the case. Only in the esophagus have I noted that in the older patient there is occasionally a fusiform type of dilatation not associated with cardiospasm, and apparently clinically asymptomatic. The tonus of gastric, small-intestinal and colonic muscle appears to be not a matter of age, but an individual characteristic dependent upon the constitution and habits of that particular individual.

Regarding the various forms of digestive dysfunctions, it is my impression that globus hystericus and functional pylorospasm are rarely found in old age. Cardiospasm is relatively common; and disturbances of small-intestinal motility and colonic tonus, spasm or atony, are found without respect to age. Anal spasm is most often the result of the abuse of laxatives in both young and old; anal atony with incontinence under pressure, is present more often in the aged than in the young. That the secretory disturbance, achlorhydria, is more often present in the aged than in the young was established years ago by Van Zandt and others, and is a recognized clinical finding. On the whole, however, digestive dysfunction may be considered a condition affecting all ages and with equal possibilities of effective treatment in the old as in the young.

Diagnosis

The diagnosis of functional indigestion must be accurate in order to be convincing to both patient and physician. There must be no lurking doubt in the mind of the physician as to the presence of organic disease or, if that uncertainty exists at first, it should be ruled out later by observation and further examinations. Otherwise such a doubt is transmitted to the patient and nullifies the effect of treatment. Thorough study is therefore the first step in diagnosis. In addition to the findings which are negative so far as organic disease is concerned, there are certain positive findings which are important in the diagnosis of functional disease. The history and physical examination give little help in excluding organic disease; however, distention, belching and diffuse and shifting abdominal distress are the most common symptoms, and tenderness to palpation over the entire course of the colon is most often found on physical examination. Gastric secretory dysfunction is revealed by gastric analysis, and

spasm of the anus and rectum and congestion of the rectal mucosa, by proctoscopy. X-ray examination, particularly fluoroscopy and serial films, reveals changes in motility and abnormal tonus in all parts of the digestive tract. Particularly valuable is fluoroscopic examination with a barium enema, which reveals abnormalities of filling time, the depth and frequency of haustral markings (tone of the colon), and the degree of distress which occurs with filling. These findings, to be significant, must be obtained with no preparation of the patient for examination, since the usual purgative prescribed by the radiologist for examination of the colon produces a temporary irritability.

The commonest form of digestive dysfunction has been termed the irritable colon, a designation which is entirely inadequate for two reasons: 1) the adjective, irritable, implies limitation of this condition to hyperirritability or spasm, whereas atony also actually plays an important part, and 2) the noun, colon, limits the condition to the large bowel, whereas the small intestine is usually also involved, and often the stomach as well. However, like other misnomers this term, irritable colon, seems to have made its place in medical nomenclature.

Treatment

The treatment of functional indigestion (with the exception of dilatation of the cardiac end of the esophagus for severe cardiospasm and, in the occasional case, dilatation of the anal sphincter for anal spasm) is based on the physiologic principle of restoration to normal by rest, and this principle of treatment applies to all types of functional indigestion.

Bed rest in the hospital is both necessary and justified in cases of prolonged dysfunction, or of severe distress and distention. The resumption of a normal diet and routine of living can then be made gradually and with the patient under observation. The mainstay of this treatment is rest—rest in bed, rest to the digestive tract by means of a bland diet, heat applied to the abdomen at regular intervals during the day, antispasmodics, supplementary vitamins, very mild sedation (when necessary), and as much mental rest, education and encouragement as is possible. Constipation, even of many years' duration, usually yields to this treatment. Temporary aids may be necessary at first, such as small (3-ounce) retention oil enemas or occasionally a saline enema (1 to 3 pints). No oral medication with any laxative effect, including mineral oil and bile salts, is permitted. The diet is divided into six parts. The first part, which is used exclusively at first, is comprised of white cooked cereals such as cream of wheat and boiled rice, milk toast, soft boiled, baked or poached eggs, warm milk, custards, junkets, Melba toast with butter, weak tea, and one cup of coffee with milk daily. Small feedings are given every two hours during the day, and six glasses of hot water are given between feedings. Ice-cold food or drink is not permitted during the entire course of treatment. As distress subsides and normal function is resumed, the diet is gradually increased. The diet used on discharge and for many months or years thereafter is well balanced. The chief articles excluded are all fried foods, pastries, raw vegetables except garden lettuce, celery and carrot sticks, uncooked fruits except orange juice diluted with

hot water, and pork products except oven-broiled bacon. Meats used are beef, lamb, chicken and turkey; and they must be broiled or roasted, not boiled. No candies, nuts, or the notoriously indigestible foods such as baked beans, oily fish, and condiments are allowed. The patient is urged to stop smoking. If alcohol is used at all, it should be very moderately, well diluted and without ice. By the time the patient is discharged from the hospital, bowel function has usually been restored to normal. The patient is instructed in the use of an oil retention enema or a saline enema, if this becomes necessary. These instructions give the patient a sense of security for future contingencies.

In some patients who may have recurrence of symptoms because of indiscretions in diet, the dietary restrictions may necessarily be life-long. In others, in whom normal function is restored after a few weeks of careful adherence to this regimen, a general diet may again be adopted.

Functional digestive disease, even though never fatal, is recognized as being highly important in preventing the well-being of the patient. When adequate care is provided, the transition from discomfort, misery and sometimes partial disability to comfort and well-being is often so striking, in some cases even so dramatic, as to give gratification to both patient and physician.

This change from discomfort, malaise and disability to one of well-being and increased vigor can be brought about by a somatic approach to the treatment of digestive dysfunction in people of all ages. There is no physiologic reason why the digestive tract of the aged should not function as well as that of the young. Even in those old people in whom long continued abuse with improper food or with laxatives has resulted in constipation, diarrhea, distention and distress, there is opportunity for relief and restoration to normal function, if adequate physical care is provided.

CLINICAL DIAGNOSIS OF ATHEROSCLEROSIS OF THE CORONARY ARTERIES*

ROBERT E. MASON, M.D.

The Department of Medicine of the Johns Hopkins University School of Medicine and the Johns Hopkins Hospital, Baltimore, Maryland

Atherosclerosis of the coronary arteries causes more deaths in this country than any other disease. The largest life insurance company (1) reports it to cause 31 per cent more deaths than cancer, its nearest rival. As befits such an important killer, its etiology and treatment are being investigated from a wide variety of approaches and it is greatly to be hoped that important advances are forthcoming. Despite the frequency with which this disease afflicts patients, however, our ability to diagnose it definitively is very poor. We sometimes make the diagnosis of coronary atherosclerosis when the coronary flow is reduced by some entirely different disease or not reduced at all, and we sometimes fail to find clinical evidence of coronary atherosclerosis when the heart is badly damaged by this disease. This inaccuracy is at times due to misinterpretation of the evidence, but just as often is due to the ambiguous nature of the evidence or to the lack of adequate tests to increase the evidence.

Clinical manifestations

When coronary disease produces clinical manifestations, the evidence is to be found in one or more of these categories: angina pectoris, myocardial infarction, disturbance of the electrical activity of the heart, or myocardial failure.

Angina pectoris is pathognomonic of inadequate coronary blood flow, and can develop whenever the myocardial demand exceeds the supply, whether the supply be reduced through narrowing of the lumen by a sclerotic plaque, or through superimposed constriction of the coronary artery. The syndrome of angina pectoris is well described in many texts but its description cannot be reiterated too often. The discomfort of angina is predominantly retrosternal, though in its course it may begin in, or radiate to the neck, the jaw, the teeth, the upper interscapular area, for varying distances out the volar aspect of either or both arms, or down to the epigastrium. The most common radiation is to the left shoulder and arm. The pain of angina is usually characterized as being dull, aching, constricting, or a sense of pressure. It may be very mild or extremely severe, but is never described as being sharp. It rarely lasts less than one minute or more than twenty minutes. It may be precipitated by exertion, emotional excitement, visceral overactivity, or exposure to cold, and is more apt to be precipitated by combinations of these factors, than by any single factor. In a given individual it tends to be brought on by the same amount of exertion—

Received for publication May 28, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28–30, 1953.

for example, the same number of stairs or the same hill. However, some patients show a considerable variation in susceptibility from month to month.

If the discomfort is not felt at some time in the retrosternal area, at least when under strong stimulus from the exciting factor, it is very doubtful that the discomfort is angina pectoris. There is similar doubt, if the pain is located predominantly near the apex of the heart or in the left chest. Such discomfort is usually due to so-called "inframammary pain," does not have the typical relation to an exciting factor as does angina, and can be traced to a psychosomatic origin in most instances.

The most characteristic of all the features of angina, however, is its exacerbation by exertion. Whether the angina has been brought on by exertion originally or merely by emotional stress, exertion after the discomfort has developed will make it worse and rest will relieve it. This is rarely true of inframammary pain. Relief of chest pain by the administration of nitroglycerine does not establish the diagnosis of angina pectoris, as nitroglycerine relaxes smooth muscle throughout the body and may relieve pain referred into the chest from a spastic viscus such as the gallbladder. A hurried physician asking leading questions can persuade many a suggestible patient that he has angina pectoris. Thus the first physician who sees a patient with chest pain is in the best position to make the diagnosis of angina. He can often make the diagnosis better by listening for two minutes while the patient describes the pain in his own words than he can by firing a battery of questions.

Myocardial infarction, like angina pectoris, is pathognomonic of obstruction of flow through the coronary arteries. It is a well known fact that myocardial infarction can occur from marked narrowing of a coronary artery without actual occlusion, and Blumgart *et al.* (2) have demonstrated that coronary occlusion may occur without myocardial infarction. Coronary occlusion, then, is not synonymous with myocardial infarction. The occlusion cannot be diagnosed clinically but the infarction can, in most instances. The commonest symptom of myocardial infarction is pain. Its location and radiation is the same as that of angina pectoris, and it too is exacerbated by exercise. It usually is a much more severe pain than that of angina and, untreated, will last a matter of hours or days rather than minutes. It is usually accompanied by evidence of injury of the heart muscle. This may be manifested by signs of myocardial irritability in the development of various arrhythmias, or by such signs of myocardial weakness as poor heart sounds, and forward and backward failure of the left ventricle with resultant shock and pulmonary edema. There may be later evidence of tissue necrosis in the development of fever, leukocytosis, elevated sedimentation rate, pericardial friction rub, and peripheral embolism from thrombosis at the site of the infarction. When such a chain of symptoms is presented the diagnosis should be clear.

Not every patient presents such a typical picture, however. Not infrequently a patient is found to have had a recent myocardial infarction without any of these symptoms (3). Other patients will be so troubled by dyspnea, nausea, or general weakness that their cardiac pain will go unnoticed. Because of the high

mortality in myocardial infarction, it is of the utmost importance to establish the diagnosis and to institute treatment as soon as possible. An electrocardiogram should be recorded from every patient in whom an infarction is suspected. This will diagnose and localize the infarction in the majority of instances (4) but the routine leads may occasionally fail to show changes of significance, even in serial records. Thus, if the electrocardiogram is typical of infarction the diagnosis may be made in the absence of clinical signs; and if the clinical picture is typical, the diagnosis may be made in the absence of electrocardiographic signs.

There are a number of disturbances of the electrical activity of the heart, including S-T segment and T wave changes and the various types of auriculoventricular blocks and bundle-branch blocks, which may occur at any time in the course of coronary atherosclerosis. This etiology must be suspected when such abnormalities are not congenital and when the many other causes of conduction disturbance can reasonably be ruled out.

Congestive heart failure likewise may result from coronary atherosclerosis which has produced such extensive scarring of the myocardium that it can no longer maintain an adequate cardiac output. This may come about after several discrete myocardial infarctions, or by diffuse scarring throughout the myocardium without any clinical evidence of episodes of infarction. Such a clinical picture is difficult at times to distinguish from simple senile heart failure due to atrophy of the myocardium without coronary disease (5).

These four syndromes then—angina, infarction, abnormality of electrical activity, and congestive failure—are the clinical manifestation of coronary atherosclerosis. As noted previously, they all may result from any disorder which interferes with coronary blood flow, and the latter two may result from a number of additional factors, which must be excluded before the diagnosis of coronary atherosclerosis can be established.

Laboratory tests

There are a number of laboratory procedures which have been reported to be of help in the diagnosis of coronary atherosclerosis. Let us evaluate these briefly, and divide them into those of established value, those of undetermined value and those of little value in the individual patient. There are two procedures which are of great value when they give positive results: the electrocardiogram and the x-ray examination. The electrocardiogram may be diagnostic of coronary insufficiency when the record is taken during a spontaneous episode of angina pectoris or when myocardial anoxia is brought about by one of the several types of stress tests (6). Davis *et al.* (7) have shown that such tests may fail to give positive results in 50 per cent of patients with known coronary atherosclerosis, and may give falsely positive results in 22 per cent of perfectly healthy normal controls. If the criteria for positive findings are made more stringent, so as to eliminate positive results in the normal controls, many diagnoses of coronary disease are likewise eliminated. Such stress tests then, give far from the clear-cut results claimed by some authors (8), though they may be diagnostic in some cases, when strictly evaluated.

The electrocardiogram is of unquestioned value in the diagnosis of acute myocardial infarction though, again, there will be a rare patient who fails to show diagnostic changes (4). In patients with remote infarctions, however, we have found 31 per cent to have entirely normal resting electrocardiograms (9). Many, but not all, of these show positive results with stress tests. Thus certain patients with coronary disease fail to show any electrocardiographic abnormality, except during a few weeks following an infarction.

X-ray examination gives evidence of coronary atherosclerosis in some patients. Rarely, the coronary arteries may be seen to contain calcium (10). More commonly, fluoroscopy or roentgenkymography may demonstrate a ventricular aneurysm following a myocardial infarction (11).

There is another laboratory procedure which is of undetermined value, although it has received much attention recently as a means for diagnosing coronary disease. This is the ballistocardiograph (12). When Starr (13) published his ten-year follow-up results in 1947, showing that those patients with abnormal records had a poorer prognosis regarding development of coronary disease than those with normal records, many groups became interested in exploring the ballistocardiograph as a diagnostic and prognostic tool. Scarborough and associates (9) have reported an analysis of records from a large number of patients with coronary disease compared with a large control group. Figure 1 shows the results in the 136 patients with remote myocardial infarction. The patients are divided according to decade, with the percentages of abnormal records shown in each decade for both normal control subjects and diseased patients. These facts stand out: there is a high percentage of abnormal records in the normal control subjects above the age of 50. These are persons who are completely normal by all other means of examination. There is a high percentage of normal records in patients under 50 with coronary disease. The intermediate decades show a high degree of overlap. It is possible then to attribute significance only to these two types of record—the abnormal record in a young patient, and the normal record in an old patient. Any other type of record cannot be said to have real significance from the diagnostic standpoint at this time, and the two significant types are from persons who constitute a small proportion of the total population. More definitive results have been found in records of the ballistocardiographic reaction to smoking in patients with coronary disease (7). Newer means of recording the underlying force of cardiac ejection are being developed, and long-term follow-up studies are being carried out to determine whether the apparently normal persons with abnormal ballistocardiograms do indeed have subclinical coronary disease, as Starr's earlier results suggest. Since this has not yet been proved, ballistocardiography has yet to be established as a valuable clinical tool.

There is a third group of laboratory tests which may be classified as having little or no value per se, as applied to an individual patient for the purpose under discussion. This group includes: detection of the various lipoprotein fractions of the serum by ultracentrifugation (14) or by electrophoresis (15); determination of the serum cholesterol level (16), the cholesterol-phospholipid

ratio, the cholesterol-uric acid-phospholipid index (17); somatotyping (18); and the flicker fusion test (19). By combining these procedures it is possible to reduce the degree of error somewhat (18), but these tests have been devised for the purpose of detecting atherosclerosis in general, and are not only far from reliable in this respect, but give no information in regard to the state of the coronary arteries.

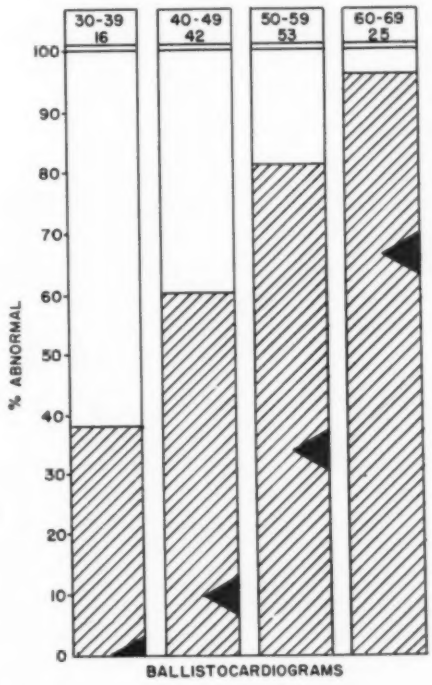


FIG. 1. Ballistocardiographic study of 136 cases of old myocardial infarction. Number of patients in each decade is indicated below the age-group designation. Black arrowheads indicate the incidence of abnormality in equivalent age-groups of 369 normal control persons; crosshatched columns indicate the incidence of abnormality in patients with old myocardial infarction. (Reproduced by permission of the authors and publisher from Scarborough *et al.* (9).)

SUMMARY

Thus far, no test has been developed which is diagnostic of coronary atherosclerosis in the majority of cases. It is only by the combined process of taking a detailed history without asking leading questions, performing an adequate physical examination, and then by applying certain of the tests which have been discussed that even reasonable accuracy of diagnosis can be attained.

REFERENCES

1. Statistical Bulletin, Metropolitan Life Insurance Company, New York; **34:** 4 (Jan.) 1953.
2. BLUMGART, H. L.; SCHLESINGER, M. J., AND DAVIS, D.: Studies on the relation of clinical manifestations of angina pectoris, coronary thrombosis, and myocardial infarction

to pathologic findings, with particular reference to the significance of collateral circulation, *Am. Heart J.* **19:** 1, 1940.

3. Landman, M. E.; Anhalt, H. S., and Angrist, A.: Asymptomatic myocardial infarction, *Arch. Int. Med.* **83:** 665, 1949.
4. Myers, G. B.; Klein, A. A., and Stofer, B. E.: I. Correlation of electrocardiographic and pathologic findings in anteroseptal infarction, *Am. Heart J.* **36:** 535, 1948.
5. Morgan, H. J.: Senescence and heart disease, *Tr. A. Am. Physicians* **64:** 54, 1951.
6. Scherf, D., and Schaffer, A. I.: The electrocardiographic exercise test, *Am. Heart J.* **43:** 927, 1952.
7. Davis, F. W., Jr.; Scarborough, W. R.; Mason, R. E.: Singewald, M. L., and Baker, B. M., Jr.: The effects of exercise and smoking on the electrocardiograms and ballistocardiograms of normal subjects and patients with coronary artery disease (in press).
8. Master, A. M.; Pordy, L., and Chesky, K.: Two-step exercise electrocardiogram, *J.A.M.A.* **151:** 458, 1953.
9. Scarborough, W. R.; Mason, R. E.; Davis, F. W., Jr.; Singewald, M. L.; Baker, B. M., Jr., and Lore, S. A.: A ballistocardiographic and electrocardiographic study of 328 patients with coronary artery disease; comparison with results from a similar study of apparently normal persons, *Am. Heart J.* **44:** 645, 1952.
10. Schwedel, J. B.: Clinical roentgenology of the heart, *in* Ann. of Roentgenol. New York, Paul B. Hoeber, Inc., 1946, vol. 18, p. 367.
11. Garland, L. H., and Thomas, S. I.: Roentgen diagnosis of myocardial infarction, *J.A.M.A.* **137:** 762, 1948.
12. Scarborough, W. R.; Davis, F. W., Jr.; Baker, B. M., Jr.; Mason, R. E., and Singewald, M. L.: A review of ballistocardiography, *Am. Heart J.* **44:** 910, 1952.
13. Starr, I.: On the later development of heart disease in apparently healthy persons with abnormal ballistocardiograms, *Am. J. M. Sc.* **214:** 233, 1947.
14. Gofman, J. W.; Jones, H. B.; Lindgren, F. T.; Lyon, T. P.; Elliott, H. A., and Strisower, B.: Blood lipids and human atherosclerosis, *Circulation* **2:** 161, 1950.
15. Barr, D. P.; Russ, E. M., and Eder, H. A.: Protein-lipid relationships in human plasma, *Am. J. Med.* **11:** 480, 1951.
16. Keys, A.: Cholesterol, 'giant molecules' and atherosclerosis, *J.A.M.A.* **147:** 1514, 1951.
17. Gertler, M. M.; Garn, S. M., and Levine, S. A.: Serum uric acid in relation to age and physique in health and in coronary heart disease, *Ann. Int. Med.* **34:** 1421, 1951.
18. Gertler, M. M.; Garn, S. M., and White, P. D.: Young candidates for coronary heart disease, *J.A.M.A.* **147:** 621, 1951.
19. Krasno, L. R., and Ivy, A. C.: The response of the flicker fusion threshold to nitroglycerin and its potential value in the diagnosis, prognosis, and therapy of subclinical cardiovascular disease, *Circulation* **1:** 1267, 1950.

DIABETES IN THE ELDERLY*

EMERY C. MILLER, M.D.† AND ALEXANDER MARBLE, M.D.‡

The Joslin Clinic and the Baker Clinic Research Laboratory, New England Deaconess Hospital, Boston, Massachusetts

There are now more elderly diabetic individuals than ever before. This is due in part to the increased length of life among persons in the general population and in part to the greater longevity of diabetics themselves, brought about by newer and better methods of treatment of diabetes and its complications, including insulin, sulfonamides and antibiotics. This is apparent whether one examines detailed statistics or walks the wards of any large general hospital. The care of the elderly diabetic has become an important geriatric problem. Conscious of this, we have undertaken to analyze our experience with the 184 diabetic patients, 70 years of age or over, whose 232 admissions were among 2,114 admissions of diabetics to the New England Deaconess Hospital during 1952. In passing, it may be noted that during the same year there were 234 admissions of persons 65 to 69 years of age. There were in all, 466 admissions in persons 65 years of age or over, representing 22 per cent of the total admissions for the year.

ANALYSIS OF DATA

Age and sex. Among the 184 patients who were 70 years of age or older at the time of admission, 125 or 67.9 per cent were females. Thus, there were more than twice as many females as males. This reflects the greater longevity of females in the general population and the higher incidence of diabetes among females than among males in the older age groups. In Table 1 is shown the distribution of patients according to age and sex. There were 34 patients 80 years of age and over, and 10 who were 85 years of age and over. The oldest patient (#30460) was 90 years of age and had been known to have diabetes for fifteen years.

Age at onset, and duration of diabetes. Because of the age-group concerned, the number of patients in whom the onset of diabetes had been below the age of 55 years was naturally somewhat small. Nevertheless these patients constitute an instructive group and indicate the trend of events in diabetes. In the 15 patients with onset under 50 years of age, the duration of diabetes ranged from twenty-two to forty-four years, with an average of twenty-nine years—a truly remarkable figure. The duration of diabetes among the 14 patients with onset at 50 to 54 years was only slightly less striking, ranging from sixteen to thirty years, with an average of twenty-two years. Detailed figures are given in Table 2.

Received for publication May 29, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28–30, 1953.

† Senior Resident in Medicine, New England Deaconess Hospital.

‡ Clinical Associate in Medicine, Harvard Medical School, and Physician, New England Deaconess Hospital.

The onset of diabetes in the 70's is uncommon and in the 80's is rare. Among the 184 patients, onset was judged to have taken place at 70 to 74 years of age in only 27, at 75 to 79 years in only 19, and at 80 years or above in only 7 patients. Furthermore, as pointed out by Joslin and Bradley (1), the date of onset in elderly patients is probably much earlier than is apparent in ordinary history-taking. This occurs because in older patients, symptoms are often mild and unnoticed or poorly remembered. A more accurate date of onset could be determined only by yearly routine examinations of the urine in the general population, a practice all too seldom carried out.

TABLE 1

Age and Sex of Patients at Time of Hospital Admission

Age (yrs.)	Sex		No. of patients
	M	F	
70–74	29	65	94
75–79	20	36	56
80–84	8	16	24
85–89	2	7	9
90 or over	0	1	1
Totals	59	125	184

TABLE 2

Age at Onset and Duration of Diabetes at Time of Study

Age at onset (yrs.)	No. of patients	Duration of diabetes (yrs.)	
		Range	Avge.
under 50	15	22–44	29
50–54	14	16–30	22
55–59	36	11–27	16
60–64	31	7–23	12
65–69	35	2–23	9
70–74	27	1–16	5
75–79	19	1–15	3
80 or over	7	1–3	1.4
	184	1–44	12

The average duration of diabetes among the 184 elderly patients was already twelve years at the time of the study. This is of interest in comparison with the figure of 14.3 years which was the average duration of diabetes at the time of death among 3,499 patients of all ages and with various times of onset, whose death occurred between January 1, 1944, and April 27, 1951 (2).

Heredity. Among the 184 patients included in the study, a history of diabetes in relatives was obtained in 65 or 35 per cent.

Character of diabetes. There is a general impression that among the elderly,

diabetes is "mild," in the sense that the insulin requirement is relatively small. This is true, in general. However, as far as hospitalized older patients are concerned, the insulin requirement may be far from negligible, as may be seen in Table 3. Only 7 of the 184 patients were discharged without insulin and 113 or 61.4 per cent were advised to take between 20 and 49 units daily. Furthermore, the insulin requirement in almost 10 per cent was between 50 and 99 units daily. Five patients required 100 or more units daily. It must be admitted that this incidence of higher dosages of insulin would probably not hold for all diabetic persons in this age group in the general population, since one would expect hospitalized patients to form the group most in need of insulin. However, our experience suggests the need and desirability of a wider use of insulin among older diabetic patients in general.

Patients were treated successfully under various insulin programs. One patient received unmodified ("crystalline") insulin alone. Eleven others received protamine zinc insulin in a single dose daily before breakfast. However, of the 177 patients for whom insulin was prescribed at the time of discharge, 162 or

TABLE 3

Daily Insulin Dose Prescribed at Time of Discharge

Insulin dose (units)	No. of patients	Per cent
0	7	3.8
20	41	22.3
20–49	113	61.4
50–99	18	9.8
100 or more	5	2.7
	184	100.0

91 per cent were taking NPH insulin daily before breakfast, either alone (62 per cent) or in combination with unmodified insulin (29 per cent) given in a single injection.

As will be brought out later, many of these patients had coronary heart disease. It is our policy to use insulin unhesitatingly in such patients if indicated. To be sure, even more than usual caution is exercised, in order to avoid hypoglycemia. Experience has shown amply that patients with coronary heart disease benefit greatly by good control of diabetes with insulin and that, if care is used in establishing the dosage, the danger of hypoglycemia is negligible.

The diet at the time of discharge from the hospital ranged from 140 to 200 grams of carbohydrate, 60 to 125 grams of protein and 40 to 120 grams of fat. The dietary prescription and the choice of actual foods require the interest, and challenge the ingenuity of the physician and the dietitian. The caloric requirements of persons in older age-groups are less than those in younger people and the digestive tract is often not so tolerant of foods less easy to digest and of those noted for formation of gas. Diets must often be modified to exclude foods requiring much chewing, since elderly patients often have single or double

dentures. The diabetic patient must be considered as a whole person in his own environment and treatment must be individualized.

Cause of admission. It is noteworthy that in only 29 per cent of patients was regulation of diabetes the chief reason for admission to the hospital. None of the 184 patients was admitted in diabetic coma and only 8 in hypoglycemia due to insulin.

Vascular complications. Only 21.2 per cent of the patients had no definite clinical evidences of arteriosclerosis. As shown in Table 4, outspoken signs of cerebral arteriosclerosis were present in 26.6 per cent of the total, of arteriosclerotic heart disease in 57.1 per cent, and of peripheral vascular disease in 48.9 per cent. The figures are not additive, since many patients had more than

TABLE 4

Vascular Complications

Complication	Patients	
	No.	% of total
Arteriosclerosis		
1. Cerebral	49	26.6
Cerebrovasc. accident	17	9.2
Other { senile deterior'n	30	17.4
Other { Parkinson's disease	2	
2. Cardiac	105	57.1
Cor. sclerosis (Ecg.)	45	24.5
Angina pectoris	9	4.9
Myocard. infarction	18	9.8
Cong. heart failure	33	17.9
3. Peripheral	90	48.9
With gangrene	30	16.3
Without gangrene	60	32.6
Hypertension (over 140/90)	102	55.4
Chronic nephritis	6	3.3
Retinitis	48	26.1

The above figures and percentages are not additive, since patients often had more than one important complication.

one important manifestation of arteriosclerosis. As will be mentioned later, 3.3 per cent of patients had chronic nephritis; in these, it may be assumed with confidence that the nephropathy was undoubtedly of a mixed type in which arteriosclerosis played its part.

Among the 49 patients with cerebral arteriosclerosis, there were 17 in whom a cerebrovascular accident was the cause of admission or occurred while in the hospital; there were others who had had such illnesses in the past. This incidence of cerebral hemorrhage and thrombosis is not unusual for the age-group concerned and is consistent with our experience with older diabetic patients in general. Senile deterioration of such severity that the patient could not carry out simple measures of personal care, such as dressing and eating, was present in 30 patients. Two patients had Parkinson's disease.

Arteriosclerotic heart disease of significant degree was present in 105 patients, 57.1 per cent of the total. In 18 patients there was a myocardial infarction, in 33 congestive heart failure, in 9 angina pectoris and in 45 there was no clinical sign but definite electrocardiographic evidence of coronary heart disease. This high incidence of coronary heart disease is not surprising, since among older diabetic patients it is by far the chief cause of death, playing an even greater role in such individuals than among persons in the general population. Among 3,499 deaths in diabetics of all ages, occurring between 1944 and 1951, 46.5 per cent were due to arteriosclerotic heart disease (2).

Arteriosclerotic vascular disease of the lower extremities was a major difficulty in 90 patients, or almost half of the entire group. In 30 of these, gangrene was present. Experience has shown that although in such patients circulatory impairment is the basic fault, in a high percentage of cases the actual lesion which precipitates acute difficulty is due to carelessness, neglect or ignorance and is therefore preventable by proper education of the elderly patient and his family.

Defining hypertension strictly as a blood pressure reading over 140/90, it was found that 102 or 55.4 per cent of the total had this condition. Thus, about 45 per cent of the total number of patients were completely normotensive, despite their age and the presence of diabetes.

Renal failure with azotemia was present in only 6 patients or 3.3 per cent of the total, although many others had proteinuria of varying degree. Although vascular involvement occurs in both young and old diabetics, in those with onset under the age of 25 years the most common cause of death after ten or more years of diabetes is renal disease, whereas in older patients the most common cause of death is coronary heart disease. In a review of the clinical records of 135 young patients with onset of diabetes under the age of 15 years, who died during the period 1944–50, Joslin and Wilson (3) found antemortem renal damage of advanced degree to have been present in at least 52 per cent of the group.

Retinitis is the outstanding nonarteriosclerotic vascular complication seen in diabetes. It is present in an extraordinarily large percentage of patients after ten or more years of diabetes and appears to bear a fairly direct correlation to the degree of poor control of diabetes. In this group of 184 patients, it was recorded in 48 cases or 26.1 per cent. In 2 of these patients the retinitis had led to blindness. In view of recent work suggesting a relationship between retinopathy and vitamin B_{12} deficiency, it is instructive to note that 1 patient (#2345) had had pernicious anemia for eight years and diabetes for thirty-two years and yet had not enough retinopathy to impair her vision significantly.

Nonvascular complications. In Table 5 are listed the nonvascular complications of significance. That 37 per cent of patients had neuropathy of clinical importance attests to the frequent involvement of the nervous system in diabetes. The manifestations included symptomatic peripheral neuritis, "neuropathic feet" (well-marked diminution of sensation and impairment of vibratory sense), paresis of the urinary bladder and "diabetic diarrhea." Of these the condition

of neuropathic feet was of most importance in that, because of diminished or absent sensitivity to pain, patients often entered the hospital with severe infection of the feet with or without gangrene, despite adequate circulation. Lacking pain, such persons had continued at home on their feet without proper treatment, allowing infection to progress often to an alarming degree.

Infections of one type or another were present in 38 per cent of patients. Of most importance were infections of the urinary tract (in 13 per cent) and of the lower extremities (in 19 per cent). Fortunately, the outlook for the diabetic patient in this regard has been enhanced immeasurably in recent years with the availability of the sulfonamides and antibiotics. These newer forms of treatment have made possible conservative foot surgery of a type formerly not possible. It is noteworthy that among the 184 patients there was no instance of carbuncle.

TABLE 5

Nonvascular Complications

Complication	Patients	
	No.	% of total
Neuropathy	68	37.0
Infections	70	38.0
Urinary tract	24	13.0
Lower extremities	35	19.0
Cancer	26	14.1
Gallbladder disease	13	7.1

The above figures and percentages are not additive, since patients often had more than one important complication.

Cancer was present in 26 patients or 14.1 per cent. The distribution of malignant disease, as to organ, was not unusual. The 1 patient with cancer of the pancreas was a man (#41420) whose onset of diabetes was said to have been at the age of 86 years; he gave no family history of diabetes.

Gallbladder disease was present in only 7.1 per cent of cases. In certain of these, cholelithiasis found by roentgenogram was the only sign of this condition. One woman aged 75 years (#26004) dying of metastatic breast cancer showed also at autopsy perforation of a gall stone into the duodenum. She had lived with known metastases to bone for fifteen years.

Not listed in Table 5 are 5 patients with duodenal ulcer. This does not support the common impression that peptic ulcer is rare in diabetes and in the aged. One man of 80 (#36265), who was given a single dose of 200 mg. of Dicumarol® because of an acute myocardial infarction, died of massive gastrointestinal hemorrhage three days later; at postmortem examination the bleeding was found to have come from a single large duodenal ulcer, clinically asymptomatic.

Included in the series was 1 patient, a woman (#28576) of 71 years with a fourteen-year duration of diabetes, who had a long-standing hemochromatosis.

Surgery. Of the 184 patients, 37 or 20 per cent underwent some form of sur-

gery. In 27 instances (not counting the amputations and minor foot surgery) the operations were amputations on the lower extremities as follows: supracondylar, 12; lower leg, 7; transmetatarsal, 8. There was only 1 death in patients following surgery; in this instance a woman (# 19272) aged 86 died of pulmonary embolism four days after a supracondylar amputation. Most of the operations on the extremities were carried out under low spinal anesthesia which, for the most part, was tolerated extraordinarily well by these elderly patients. With special care to minimize hypotension during anesthesia, shock during and following operation was uncommon.

Deaths. There were 23 deaths, which occurred in the patients while in the hospital. The causes were as follows: cerebrovascular accident, 5; myocardial infarction, 9; congestive heart failure, 2; uremia, 1; cancer, 4; and pulmonary embolism, 2. One instance of pulmonary embolism occurred after a supracondylar amputation, and the other in a patient who appeared to be recovering from a cerebrovascular accident. In 13 of the 23 cases, permission for postmortem examination was obtained.

DISCUSSION

The studies reported in this paper, although based on a relatively small series of patients, have indicated clearly the problems posed by the increasing number of elderly diabetic persons in the population. In our group, patients 65 years of age and over accounted for 22 per cent of the total number of diabetic admissions to the hospital in a single year. The number of such patients over the country must of necessity form a significant portion of the practice of many physicians. It is important to recognize that in this age-group treatment of diabetes must be just as carefully planned and executed as in younger patients. In fact, great pains must be taken because of the special problems and complications often encountered which affect the home life and social status of the individual, and his capacity for self-care and maintenance. As an outstanding example, one may cite the matter of infection and gangrene of the toes and feet. In this instance, because of circulatory deficiency or neuropathy or both, lesions of such serious nature may develop that major amputation may be necessary. Careful consideration may show that the acute difficulty could have been prevented by proper foot care and early treatment. Only by continuous and systematic education of the patient and his family may the physician hope to lower the incidence of these dreaded complications. It is gratifying that in recent years considerable advance has been made in this regard. Furthermore, under the protection of antibiotics it has been possible to reduce greatly the need for major amputations. With present-day high hospital costs, the financial burden imposed upon the patient and the community because of prolonged hospitalization for foot lesions is very great.

Although the extraordinary tendency for uncontrolled diabetes to cause vascular degeneration has long been known, it is only during the insulin era, in which greater length of life with diabetes has been possible, that the high incidence of vascular disease has become apparent. Young and old are affected

alike and the process is universal throughout the body, with manifestations most troublesome and handicapping in the major organs and tissues: the eyes, heart, kidneys, lower extremities and nervous system. Vascular disease of one type or another is admittedly common among persons in the general population who are 70 years of age or older. Nevertheless, accepting such as a base line, the incidence among our 184 diabetic patients was certainly greater—at least in clinical manifestations in certain parts of the body. Recent studies have shown that by careful and continuous control of diabetes over a period of years it is possible to prevent or postpone these complications or sequelae (4). To maintain control over many years is not easy. It is the serious responsibility of the physician to teach and guide his diabetic patients during frequent visits, so that maximal success may be attained.

SUMMARY

1. An analysis of 2,114 hospital admissions of diabetic patients during 1952 showed 22 per cent of these to have been in persons 65 years of age or over. There were 184 patients 70 years or older.

2. Among the 184 patients, there were twice as many females as males. The average duration of diabetes was twelve years; among 15 with onset under the age of 50, the duration of diabetes ranged from twenty-two to forty-four years. In only 46 patients was the onset of diabetes at age 70 or above.

3. The daily insulin requirement of 61 per cent of the 184 patients was between 20 and 49 units daily. In 10 per cent it was 50 to 99 units, and 5 elderly patients required 100 or more units daily.

4. Among complications, vascular disease was most common and most important. Arteriosclerotic heart disease was present in 57 per cent, peripheral vascular disease in 49 per cent, retinitis in 26 per cent and hypertension in 55 per cent. Important nonvascular complications included neuropathy in 37 per cent, infections in 38 per cent and cancer in 14 per cent. Myocardial infarction accounted for 9, and cerebrovascular accidents for 5 of the 23 deaths in the series. Surgery was performed in 37 of the 184 patients; in 27 of these, amputations were carried out as follows: supracondylar, 12; lower leg, 7; and transmetatarsal, 8.

5. The importance of careful control of diabetes in the elderly and of continuous education of the patient and his family is stressed.

REFERENCES

1. Joslin, E. P.; Root, H. F.; White, P., and Marble, A.: Treatment of Diabetes Mellitus, ed, 9. Philadelphia, Lea and Febiger, 1952, p. 259.
2. *Ibid.*, p. 186.
3. Joslin, E. P., and Wilson, J. L.: Lessons for future treatment from 472 fatalities in diabetic children, *Brit. M. J.* **2:** 1293–1296, 1950.
4. Keiding, N. R.; Root, H. F., and Marble, A.: Importance of control of diabetes in prevention of vascular complications, *J.A.M.A.* **150:** 964–969, 1952.

EVALUATION OF LIVER FUNCTION TESTS

I. S. RAVDIN, M.D.

The Harrison Department of Surgical Research, School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania

The more extensive our knowledge of the functions of a given organ, the more difficult it has become to measure these functions by any single test. It is now generally agreed that renal function is much more complex than when Rowntree and Geraghty described phenolsulphonphthalein elimination as a means for its determination. The glomerular and tubular functions are mediated by a number of conditions and circumstances which cannot be evaluated by so simple a test.

The liver, which is the largest single organ in the body, is concerned with functional activities of even a more diversified character. Not only is the liver capable of making important changes in many of the substances that come to it, but it synthesizes others, such as the bile salts; it is the site of origin of various enzyme systems; it is the most important storehouse of labile carbohydrate and protein; it synthesizes certain globulins and the serum albumin; it is the site of the synthesis of prothrombin; in addition to these functions, it is capable of detoxifying various substances and, through its external secretion, of eliminating certain products of metabolism. Life is impossible when the total liver mass has been destroyed or removed.

In an organ with so many functions it is easy to understand why no single test can possibly give a clear picture of the extent of functional derangement.

Although it is essential for us to know, in general, what the major functions are, it is just as important that we know the marginal reserve which must be present before gross hepatic incompetency can be demonstrated. It is well known that certain of the important hepatic functions can be maintained when only a small part (20 per cent) of the total liver mass remains normal, whereas others are impaired when only 20 per cent of the total liver mass has been totally deranged. Any single test, therefore, is completely inadequate to give sufficient information about the impairment of the functional activities of this vital organ.

The diagnosis of liver disease should include a carefully taken history and a meticulously made physical examination. It should involve also a variety of clinical tests, many of which have come to be looked upon as tests of hepatic function, as well they should be. The history will frequently reveal factors which suggest the presence of hepatic disease and, in many instances, will provide the clues concerning the etiology of the patient's disease. The physical examination will frequently give evidence of the presence of collateral disease and may give direct evidence of the primary factors involved in the hepatic disorder. It will further give information on the size of the liver and on certain of its physical characteristics.

Received for publication June 29, 1953.

The confirmation of the presence of hepatic disease and the clarification of its nature will, however, require additional steps. We must first establish the existence of liver dysfunction. We must then estimate the severity of the liver injury and we must determine the existence of collateral disease and determine the primary and secondary factors involved with the liver dysfunction. We must determine whether the patient can best be treated by medical or by surgical means, or by a combination of these. Finally we must estimate the prognosis, which depends not only upon an accurate diagnosis, but upon the degree to which hepatic parenchymal injury has occurred, the possibility of preventing further injury, and the facility with which repair can take place under the chosen method of therapy.

When the suspicion of liver disease has been confirmed, a group of properly selected and performed function tests will give evidence which will be helpful in determining the degree of parenchymal injury which has taken place. The functions which have been disturbed and the degree of the disturbance will depend, not only on the nature of the disease, but also upon the stage in its course. It is of the greatest importance that we recognize the fact that two patients, similarly exposed to the same stage of the disease, may vary widely with regard to the results of function tests. A patient who, for a period of time prior to injury, has been ingesting an adequate amount of an adequate protein, will be less susceptible to injury under a wide variety of circumstances than will the patient whose nutritional intake has been inadequate prior to the same type of injury. Similarly, subsequent to injury the patient whose dietary intake has been adequate in total calories and protein, will show evidences of regeneration much sooner than will the patient whose dietary intake, on the whole, has been insufficient in total calories and protein. Thus, no single function test can possibly be expected to provide adequate information concerning the functional activity of the liver.

Acute liver injury of even limited extent histologically, may cause very marked abnormalities in the results of many of the function tests, whereas chronic liver injury of a more extensive character may be associated with normal or nearly normal values. Even when most of the tests give evidence of only minor variations from the normal in many functions, the patient exposed to the insult and trauma of anesthesia and operation and to a postoperative period of gastric distention, which impairs the hepatic blood supply, may pass rapidly into a state of hepatic incompetency. Many functions which the liver normally carries on simultaneously make it highly unlikely that any single test will ever be available to give information of practical diagnostic importance on the degree of variation from the normal affecting all of these functions in early or moderate hepatic disease. Conclusions drawn from testing one functional activity may not have the slightest application to other important hepatic functions. Complete function in the liver is dependent on many conditions, some of which involve primarily the liver itself, and some of which are dependent on factors unassociated with the liver cell, but in which liver damage takes place secondarily.

Such conditions as anoxemia, dehydration, hemorrhage, trauma and infection may transform a completely normal liver, histologically and physiologically, into a totally incompetent viscus. We must look with considerable prejudice on those tests which give evidence of normal function when the major portion of the normal gland has already been seriously interfered with.

Furthermore, at some stages of certain of the acute hepatic diseases, rapid changes take place, so that results of a test may be a negative one day, and strongly positive the next, with no apparent change in the clinical condition of the patient. Thus, frequent repetition of tests is necessary if the patient is to be properly followed.

Finally, it must be remembered that most of the hepatic function tests are affected by certain conditions in which hepatic involvement may not be the predominant or primary factor. Thus the protein concentration of the serum and the albumin-globulin ratio may be seriously affected in certain types of nephrosis. The blood cholesterol level is involved in thyroid and other diseases. The phosphatase concentration may be greatly elevated in certain bone diseases. The bilirubin and urobilinogen may be affected in hemolytic processes. Bromsulphalein elimination is affected in the presence of fever and results with the cephalin-cholesterol flocculation test are frequently found to be abnormal in the presence of malaria and other diseases. It is, therefore, important to realize that the hepatic function tests are frequently not specific for any particular type of hepatic disease, nor do they always indicate whether the disturbance results from primary or from secondary involvement of the liver.

These tests are frequently of considerable importance in establishing the presence of hepatic disturbance in patients without visible jaundice. They are of value in the differential diagnosis of jaundice, in estimating the severity of hepatic parenchymal injury, in periodically demonstrating changes in the degree of injury, and in indicating regeneration in the after-period. Thus they are valuable in providing evidence of recovery from hepatic injury.

As a rule it is not in the single test of hepatic function that the clinician can take comfort, but in the findings from an aggregation of such tests, each of which has been developed to measure some functional activity. When these results are compared with the results of a history and a careful physical examination, they become an invaluable part of the complete over-all study of the patient, and they provide an assessment of the patient's condition that cannot be determined by any other means.

DIAGNOSIS AND MANAGEMENT OF ACUTE PANCREATITIS IN GERIATRIC PATIENTS*

BROCK E. BRUSH, M.D., RALPH CARLSON, M.D.
AND FRANK ZELLER, JR. M.D.*

The Division of General Surgery, Henry Ford Hospital, Detroit, Michigan

INTRODUCTION

Acute pancreatitis should be considered in the differential diagnosis of every severe upper abdominal pain. Because only the very severe forms of the disease have been sufficiently stressed in the literature, we feel that many of the less dramatic and less fulminant cases are not recognized, and thus proper treatment is not instituted as early as would otherwise be possible. Acute pancreatitis was recognized by Rokitansky in 1853 and described adequately by Fitz in 1889 and later by Moynihan in 1925; yet today it does not receive adequate consideration as an etiologic factor in the diagnosis of upper abdominal conditions. The acceptance of an elevated blood diastase or amylase value as evidence of pancreatitis has led to the recognition of several forms of the disease, giving clinical pictures varying greatly in degree. The severity of symptoms usually reflects the degree of pathologic involvement of the gland. However, the classic picture of the disease, which includes shock and cyanosis, is frequently absent and only much milder clinical manifestations are seen. Since the stimulating work of Elman and of Somogyi our recognition of acute pancreatitis has increased, until at present at the Henry Ford Hospital 1 case is diagnosed among each 2,100 hospital admissions. The findings in a group of 31 patients over the age of 65 years with acute pancreatitis provide the data for this report.

ETIOLOGY

Many theories have been advanced as to the cause of this disease, but that of increased pressure in the pancreatic duct appears to be the most tenable. Whether this increased pressure is due to obstruction at the bile papilla from stone or cicatricial contraction, or due to obstruction in the pancreatic duct from stone or metaplasia, it seems to be the initiating factor. The occurrence of an attack after the consumption of alcohol followed by a large meal has led some to feel that the edema of an acute duodenitis may temporarily obstruct the bile papilla. When a common channel is present, the bile may be forced back into the pancreatic duct and act as an agent in instigating the attack. It has frequently been observed that disease of the biliary tract is present in many instances of pancreatic disease and therefore must be regarded as an important etiologic circumstance.

Received for publication May 30, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28-30, 1953.

SYMPTOMS

The symptoms of acute pancreatitis vary with the type of the disease and the phase in which it is seen. It is our belief that there are many degrees of severity, and that edema of the pancreas is just a mild variant of pancreatic necrosis. Hemorrhage into the peritoneal cavity occurs usually with severe forms of the disease, and its occurrence markedly alters the abdominal findings.

In most cases the outstanding clinical feature is the severity of the pain. However, diagnostic blood diastase levels are sometimes obtained in patients with only moderate discomfort; thus, routine diastase determination can prevent mismanagement due to an erroneous clinical diagnosis. Some relief of pain is usually obtained when the patient sits up and leans forward. Typically, the pain is sudden in onset, most pronounced in the midepigastrium, and often transmitted to the back. Nausea and vomiting are present early in 90 per cent of the patients. The degree of shock varies with the severity of the disease, but it is frequently minimal and usually much less than that described in the classic concept of acute pancreatitis. It was present in only 10 per cent of our group of 31 patients over the age of 65 years. Often the muscle spasm is minimal and the upper abdominal distention only moderate in patients in this older age group. Pronounced muscle guarding was present in only one third of these 31 patients. The maximum point of tenderness is usually in the midline, but may be over any part of the gland. Clinical jaundice was found by Fallis (1) in 25 per cent of patients with acute pancreatitis in all age groups but was present in 45 per cent of our series over 65 years of age. The presence or severity of jaundice does not necessarily reflect the severity of the disease. When extreme jaundice occurs an ampullary stone should be suspected.

LABORATORY FINDINGS

The laboratory is of great aid in the diagnosis and management of acute pancreatitis, since elevation of the blood diastase level is the chief means of confirming the diagnosis. This test must be repeated frequently, for the diastase value often may not become elevated for several hours after the onset of the disease; moreover, it usually will return rather rapidly to normal after two or three days. An increase in blood diastase occurs in some other abdominal emergencies, such as perforated or penetrating ulcer, but levels above 280 per cent of normal, together with a good history, are diagnostic of pancreatitis. In this series the average value for blood taken within seventy-two hours after onset, was 777 per cent of normal. An elevated lipase level may be of diagnostic aid in later stages of the disease.

The average body temperature was 99.7°F. and the average white blood cell count was only 12,900 per cu. mm. The fasting blood sugar concentration should be closely observed, since the initial value was over 200 mg. per 100 cc. in 19.3 per cent of the patients in this series. The blood calcium level, which may be of some prognostic significance, was markedly lowered in only 1 instance. Peritoneal aspiration has not been used by us as a diagnostic procedure.

DIFFERENTIAL DIAGNOSIS

The conditions which most often simulate late acute pancreatitis are:

1. Acute cholecystitis.
2. Penetrating or perforated ulcer.
3. Intestinal obstruction.
4. Coronary disease.
5. Mesenteric thrombosis.

While the diastase test and leukocyte count are being determined, scout x-ray films of the abdomen should be taken whenever possible. Absence of free air gives some assurance that a perforated ulcer is not present and the pattern of gas in bowel may rule out other abdominal conditions. In some instances of acute pancreatitis, dilatation of an isolated loop of proximal jejunum may be seen on the scout film. Because of the severe epigastric pain and occasional cyanosis and pallor, coronary occlusion must frequently be excluded; therefore an electrocardiogram was taken in the diagnostic work-up in over half of our series. In acute cholecystitis there is usually more muscle spasm and local tenderness over the gallbladder area than is seen in pancreatitis.

MANAGEMENT

The objectives in the management of acute pancreatitis include:

1. Relief of pain.
2. Reduction of pancreatic secretory activity.
3. Prevention of infection and peritonitis.
4. Management of diabetes, when present.
5. Correction of fluid and electrolyte balance and thus prevention of shock and maintenance of a satisfactory urinary output.

For relief of pain, Demerol®, atropine, and Banthine® are the drugs of choice. These do not have the disadvantage of morphine, which causes spasm of the sphincter. Either Banthine® (methantheline bromide) or atropine, by blocking vagus action, reduce the external secretion of the pancreas and also, by paralyzing sphincteric action, assure that the intraductal pressure will not be raised (2). Hypertonicity and spasm in and about the sphincter of Oddi are reduced

Continuous gastric suction has a twofold benefit, for it not only relieves gastric distention and thus a great deal of discomfort, but also reduces to a minimum the acid and gastric secretions entering the duodenum (3). Acid in the duodenum has been shown to cause spasm of the sphincter of Oddi and gastric juices in the upper small intestine stimulate the formation of secretin.

Continuous massive abdominal stupes are often very beneficial in reducing abdominal distress and promoting comfort.

Nerve block may be very useful in cases with severe pain which is only partially relieved by drugs. Paravertebral sympathetic block, splanchnic block and fractional epidural block are all available, with the latter having the advantage that it can be used for several days if necessary, without subjecting the patient to the additional discomfort of a new injection each time additional analgesia is required (4). Procaine hydrochloride and tetraethylammonium chloride ad-

ministered intravenously have disadvantages which make them less desirable than the other drugs previously mentioned for the purpose of nerve block. These nerve-blocking agents may alter the course of the disease but should not be considered a substitute for other useful measures of treatment.

Trypsin inhibitors derived from soybean have been used experimentally in animals with great success, but are as yet not ready for general clinical use.

Antibiotics have greatly reduced the mortality of acute pancreatitis, probably by their control of bacterial infection and peritonitis. Penicillin and streptomycin have been effective but recently aureomycin has been shown to be of great value in the treatment of experimentally produced pancreatitis (5). Aureomycin and terramycin are concentrated in the bile and are also very effective against the organisms found in peritonitis; but they are not without danger.

Corticotropin has been given a limited trial and has not seemed to limit the progression of severe hemorrhagic pancreatitis (6).

An adequate urinary output should be maintained by the use of plasma, blood, and sodium chloride solutions to insure an adequate blood volume. The presence of shock and hypotension should be combatted by whole blood and plasma. Hypocalcemia, when it occurs, should be corrected in order to prevent neuromuscular alterations and myocardial abnormalities. Potassium and chloride values should be maintained within normal limits.

Pancreatic secretion will be increased if the blood sugar level becomes either very high or very low; therefore blood sugar values should be determined frequently and an attempt made to keep them within relatively normal limits. Insulin may be required for control of an elevated blood sugar level and it also may be used judiciously to aid in the metabolism of any glucose which is to be administered.

Constant supervision and repeated abdominal examinations are very important parts of the conservative treatment of patients with acute pancreatitis. This is especially so in patients of the geriatric age-group, since complications must be noted early and treated vigorously if the mortality and morbidity are to be kept low in this serious disease. If surgical intervention should be required in order to be certain of the diagnosis, a small incision under local anesthesia is all that is necessary. Definitive surgery should await a more favorable time. The symptoms in favorable cases will lessen in four or five days but exacerbations, as indicated by a return of fever and leukocytosis, may occur (7, 8).

A low-fat diet should be given for a prolonged period and Banthine® therapy continued indefinitely. During convalescence the abdomen should be examined for the possible appearance of palpable masses, indicating the development of pseudocysts or abscesses. Since gallbladder disease is present in over 70 per cent of those who suffer from acute pancreatitis, investigation of the gall bladder is indicated; if disease is found, its correction at a later date is important, in order to lessen the likelihood of a recurrence.

RESULTS OF TREATMENT

Prior to 1935, patients in the early stage of acute pancreatitis were operated upon, and the mortality was 45 per cent. During the past five-year period,

1945–1950, 122 patients were treated by conservative nonoperative measures, with only 3 per cent mortality. In the group of 31 patients over the age of 65 (all with a blood diastase level above 300 per cent of normal), there were 3 deaths. One of these was in a severe diabetic with a diastase value 640 per cent above normal and a blood sugar level of 344 mg. per 100 cc.; the second was in a patient who had a concomitant attack of coronary disease, and the third was in a patient who had severe acute pancreatitis with a stone impacted at the sphincter of Oddi.

CONCLUSIONS

1. Twenty per cent of all cases of acute pancreatitis occur in patients who are over 60 years of age.
2. Severe upper abdominal pain is the chief symptom. This is frequently relieved by forward bending of the trunk.
3. Biliary tract disease co-exists in 74 per cent of cases.
4. Conservative therapy is the treatment of choice.
5. With early recognition and the institution of treatment, the management of this condition may show very satisfactory results in patients of the geriatric age group.

REFERENCES

1. Fallis, L. S.: Acute pancreatitis: observations on two hundred and fifty cases, *J. Internat. Coll. Surgeons* **16:** 337–340 (Sept.) 1951.
2. Hinton, W. J.: Recent advances in the management of pancreatitis; acute and chronic, *Bull. New York. Acad. Med.* **28:** 425–439 (July) 1952.
3. Fallis, L. S.: Acute pancreatitis, *Proc. Roy. Soc. Med.* **46:** 113–115 (Feb.) 1953.
4. Dale, W. A.: Splanchnic block in the treatment of acute pancreatitis, *Surgery* **32:** 605 (Oct.) 1952.
5. Persky, L.; Schweinburg, F. B.; Jacob, S., and Fine, J.: Aureomycin in experimental acute pancreatitis of dogs, *Surgery* **30:** 652–656 (Oct.) 1951.
6. Berk, J. E.: Management of acute pancreatitis, *J.A.M.A.* **152:** 1–6 (May 2) 1953.
7. Fallis, L. S., and Plain, George: Acute pancreatitis, *Surgery* **5:** 358–373 (March) 1939.
8. Fallis, L. S.: Diagnosis and treatment of acute pancreatitis, *Texas State J. Med.* **37:** 223–227 (July) 1941.

ABDOMINAL SURGERY IN THE AGED PATIENT*

E. LEE STROHL, M.D.† AND W. G. DIFFENBAUGH, M.D.‡

St. Luke's Hospital, and the University of Illinois College of Medicine, Chicago, Illinois

The objective of the American Geriatrics Society is the clinical study of geriatrics in the broadest sense. This includes the study of the causes, the prevention and treatment of diseases of advancing years, the rehabilitation of patients, and the dissemination of this knowledge (1).

Despite the advances in the field of surgery, there lingers a traditional reluctance on the part of physicians to refer old patients for surgery. Is it possible that our surgical failures of thirty years ago influence the thinking of physicians more than our surgical successes of today?

When one is confronted with the problem of surgery in the elderly patient, a few basic concepts should be borne in mind (2).

1. In 1850, the half million old people could be told they were too old for surgery, but the 12½ million old people of the 1950's refuse to be considered so carelessly. This group of people is increasing in size, and will approach 23 million in 1970.

2. The chronologic age does not parallel the physiologic age. On many occasions, the patriarch of 80 can undergo surgery more satisfactorily than the ne'er-do-well in his 30's.

3. Tissue healing occurs equally well at all ages. The elderly patient has the same ability to lay down fibrous tissue as has the young adult (3).

4. In old patients, the complications in the preoperative and postoperative periods are higher. These complications, however, are not related necessarily to the problem at hand.

5. Taking the foregoing factors into consideration, the criteria for surgery in the elderly patient are:

A. Is surgery essential to save the patient's life?

B. Will operation remove the physical disability, and rehabilitate the patient to his more or less normal status?

C. Will surgery relieve the patient or cure him of a malignant disease?

The average life expectancy, based on the result of the 1940 U. S. census, is a helpful figure when evaluating a surgical problem in an elderly patient, as shown in Table 1. We discuss this table with the patient and his relatives, when surgery is indicated (4).

Received for publication May 30, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28–30, 1953.

† Attending Surgeon, St. Luke's Hospital, and Clinical Associate Professor of Surgery, University of Illinois. Office address: 122 South Michigan Avenue, Chicago 3.

‡ Associate Attending Surgeon, St. Luke's Hospital, and Clinical Assistant Professor of Surgery, University of Illinois.

PREOPERATIVE PREPARATION

In the preoperative survey, efforts should be directed toward the patient as a whole, and the following should be considered:

1. The psychologic status of the patient.
2. The cardiovascular status.
3. The condition of the respiratory system.
4. The fluid, chemical, electrolyte and nutritional changes.
5. The renal and genito-urinary status.
6. The presence of liver damage.
7. The hormonal changes.
8. The choice of anesthesia.

TABLE 1

Life Expectancy, According to Age Decades

Age (yrs.)	Life expectancy (yrs.)
65	12.8
70	10
75	7.6
80	5.7
85	4.3
90	3.3
95	2.6
100	2.1

TABLE 2

Results in Abdominal Surgery in Aged Patients

No. of patients & type of surgery	Deaths	Mortality rate (%)
125 (Elective)	6	4.8
75 (Emergency)	7	9.3
200 (Undergoing 230 operations)	13	6.5

ELECTIVE SURGERY COMPARED WITH EMERGENCY SURGERY

It is well known that emergency surgery, at any age level, carries a higher mortality rate than elective surgery. In the aged patient, acute conditions are more prone to develop, because of lowered systemic reserve. It is our policy to convert emergency situations, whenever possible, into situations in which safer elective procedures may be used.

One hundred and twenty-five patients had elective surgery, and 6 patients died—a mortality rate of 4.8 per cent (Table 2). Seventy-five patients had emergency surgical procedures and 7 patients died—a mortality rate of 9.3 per cent. There were 13 deaths in the 200 patients having 230 operations—a patient mortality rate of 6.5 per cent. Thus the mortality was approximately twice as high in the emergency group as in the elective group.

BILIARY TRACT DISEASE

Biliary tract disease is the most common condition requiring abdominal surgery in the patient over 70 years of age. One would expect this to be true, because of the high incidence of gall stones in older people (5). This condition is found more frequently in females than males. The ratio is roughly 3 to 1.

Fifty of our 75 emergency-surgery patients, or 2 of every 3, had complications involving the biliary tract—acute cholecystitis, gangrene or perforation, in 18 patients; common duct obstruction in 20 patients; and carcinoma of the gall bladder or pancreas in 12 patients (Table 3).

Cholecystectomy is the operation of choice. It was carried out in 38 of the 39 patients having surgery for chronic cholecystitis. The common duct was explored in 15 of the 39 patients.

Eighteen of the 75 patients, or roughly 1 out of every 4 patients, had acute cholecystitis. Furthermore, 10 of the 18 patients, with acute cholecystitis, had gangrene or perforation. Cholecystectomy was performed in 12 of the 18 patients. In the poor-risk patient in an advanced stage of the disease, cholecystostomy will release the obstruction and provide drainage (6). Cholecystostomy was performed in 6 patients.

TABLE 3

Biliary-Tract Complications

Complication	No. of patients
Acute cholecystitis, gangrene, or perforation	18
Common-duct obstruction	20
Carcinoma (gallbladder or pancreas)	12

Seven patients died following surgery, a mortality rate of 9.3 per cent. Four of the 7 deaths were in patients with carcinoma of the gall bladder or pancreas. Two deaths followed gangrene and perforation of the gall bladder. One patient with a high temperature died eighteen hours following cholecystectomy and common duct exploration. Autopsy examination revealed a portal vein thrombosis.

LESIONS OF THE LARGE BOWEL

Fifty-five patients had 80 operations for diseases of the colon. Carcinoma, as would be expected, was the dominant condition. It was present in 51 patients. The cancer was located in the left colon in 40 patients, and in the right colon in 11 patients. Sixteen patients, or approximately 1 out of every 4 patients, entered the hospital with acute obstruction. All of the obstructions were due to carcinoma, with the exception of 1, which was due to diverticulitis.

In the elderly patient, with acute obstruction of the colon, it is our practice to perform a diverting colostomy, as a preliminary procedure. Nine patients with lesions of the sigmoid or rectum had three-stage operations, and 7 patients had two-stage operations.

One patient died, a mortality rate per patient of 1.8 per cent (Table 4).

HERNIA

We have elected to place hernia in the category of abdominal surgery, since it is an abdominal problem, primarily. Weight is lost as a part of the aging process. The loss of fat from the tissues of the abdominal cavity produces hernial orifices, where none had been present before (7). This process is noted particularly in the femoral canal, but may occur in the inguinal canal. The appearance of a Richter's type of hernia in the aged, can be explained on this basis.

TABLE 4

Operations for Lesions of the Large Bowel

Type of surgery	No. of patients	Deaths
Primary resection	39	1
2-Stage operation	7	0
3-Stage operation	9	0

TABLE 5

Operations for Hernia (45 Patients)

Type of hernia		No. of operations	Bowel resection	Deaths
Inguinal		41	2	0
Incarcerated	19			
Strangulated	2			
Femoral		6	2	0
Incarcerated	4			
Strangulated	2			
Incisional		3	0	0
Incarcerated	1			

There were 45 patients in this group, who had 50 operative procedures. Inguinal hernia was encountered in 41 patients, all males. Twenty-one of these hernias were incarcerated, or strangulated. Resection of gangrenous bowel was carried out in 2 patients. Six patients had surgery for femoral hernia. Four of these hernias were incarcerated and 2 were strangulated. Resection of gangrenous bowel was carried out in 2 patients. Three patients had incisional hernias, 1 being incarcerated.

There were no deaths in these 45 patients, who had 50 operations (Table 5).

LESIONS OF THE STOMACH AND DUODENUM

Carcinoma of the stomach represents the bête noire of surgery, in the aged patient. Six of the 8 carcinomas of the stomach were inoperable. Two resections were carried out. Palliative gastroenterostomy was performed in 3 patients, one of whom died of cardiac failure, twenty-four days postoperatively. It is our

opinion that gastroenterostomy has little or no place, in the treatment of inoperable carcinoma of the stomach.

Seven patients had peptic ulcers—3 gastric, and 4 duodenal. Resection was carried out on all the gastric ulcers, with no deaths. Three of the duodenal ulcers were perforated, and all were closed surgically. One patient had a gastroenterostomy for an obstructing duodenal ulcer. One patient died from cardiac failure twenty-four hours after closure of a perforated duodenal ulcer of five hours' duration.

ACUTE APPENDICITIS

We have pointed out in a previous communication, the similarity of the disease in infants and the aged (8). The child cannot describe his symptoms and in the aged, the symptoms are minimized as "a little gas, or constipation." Appendicitis is usually fulminating in type, progressing to gangrene and perforation in a short period of time. The frequent use of laxatives by the aged contributes to the severity of the disease.

Seven patients had surgery for appendicitis; 3 of the 7 had gangrenous appendicitis, 3 had perforations, and 1 had an abscess. Four of the 7 patients had taken laxatives following the onset of symptoms.

Two of the 7 patients died, a mortality rate of 28.5 per cent.

OBSTRUCTION OF THE SMALL BOWEL: ABDOMINAL EXPLORATION

Two patients had acute small-bowel obstruction, due to adhesions following previous surgery.

One patient was explored and a large cyst of the liver was excised. The patient died on the sixteenth postoperative day, from a pulmonary embolus.

OPERATIVE CONSIDERATIONS

Preoperative medication must be used sparingly in the elderly patient (9, 10). An adequate airway and oxygenation are essential (11).

The surgery should be performed carefully, yet rapidly, with a minimum of trauma to the tissues. An appreciation of the time factor is important, since the mortality rate is directly related to the length of anesthesia and the duration of surgery.

Blood replacement must be adequate to maintain the circulating blood volume (12–15).

Careful and repeated cleansing of the trachea and bronchi is essential. This should be carried out during the operation, and before the patient leaves the operating room.

POSTOPERATIVE CARE

In the postoperative period, attention should be directed along the following lines (16–20):

1. Nursing service.
2. Prevention of respiratory complications.
3. Prevention of cardiovascular complications.

4. Fluid and electrolyte requirements.
5. Prevention of urinary-tract complications.
6. Judicious use of sedatives and analgesics.
7. Prevention of gastrointestinal complications.

POSTOPERATIVE COMPLICATIONS

The postoperative complications can be kept to a reasonable minimum, by vigilant attention to minor details.

In the preoperative period, 108 patients (54 per cent) had significant findings which added to the risk of surgery. Whenever possible, these changes were corrected before surgery. Nevertheless, in 35 patients (17.5 per cent) significant postoperative complications developed. The cardiovascular system, the pulmonary tree, and the genito-urinary tract accounted for the complications in most of the patients (Table 6).

TABLE 6

Postoperative Complications (35 Patients)*

Disease	No. of patients
Cardiovascular	15
Respiratory	8
Urinary-tract	9
Infection	4
Mental confusion (postoperative only)	3

* Some patients had more than one complication.

DISCUSSION

We have pointed out the increasing number of older people, with each decade. As physicians, we must be prepared to meet the medical obligations and responsibilities in this age-group.

The mortality rate of emergency surgical procedures is approximately twice as great as that of elective procedures. Whenever possible, the emergency problem should be converted to an elective situation before surgery is attempted.

Such measures are practical in most instances of biliary tract disease, in that surgery may be recommended before the emergency arises. The hernia problem falls into the same category. These two groups represented 120 of the 200 patients in this study.

The preoperative survey should be directed toward the patient as a whole. The associated diseases of degeneration add to the risk of surgery (21). Each system must be scrutinized with care. Postoperative complications, or catastrophes can be avoided or minimized, if one is alert to their possible occurrence. Again—it is very important that doses of sedatives or analgesics be small. The elderly patient should have about one-half or two-thirds of the usual adult dose.

Complete cooperation between the physician, the anesthesiologist, and the surgeon is essential.

The nursing service is of prime importance in the care of the elderly patient. Nevertheless, as soon as the critical phase has passed, these patients must be encouraged to develop self-sufficiency. No patient is nursed to death as quickly as an aged patient.

Significant preoperative complications were present in 108 of the 200 patients. In many instances these conditions were corrected before surgery. Nevertheless in the postoperative period, complications developed in 35 of the patients. It should be emphasized that the postoperative complications were not related, necessarily, to the primary pathologic condition requiring surgery.

In reviewing the causes of the 13 deaths, we found that cardiac disease and peripheral vascular accidents accounted for 9. Seven deaths followed emergency surgery, and 6 followed elective surgery. Four of the 6 patients having elective surgery had inoperable carcinomas.

Our poor results in carcinoma of the stomach are discouraging, but our results in carcinoma of the colon are encouraging.

Appendicitis presents a challenge in the aged patient. An educational program is needed, stressing the hazards of cathartics. More cautious and complete examination for appendicitis is indicated.

The postoperative care is of vital importance. However, most older patients will withstand extensive surgery well, if the proper measures are used in the preoperative, operative, and postoperative periods.

The morbidity and mortality in surgery of the aged patient have been reduced. We must continue our efforts to bring them in line with those for other age groups.

SUMMARY AND CONCLUSIONS

1. The criteria for surgery in the aged patient are stated.
2. The preoperative survey of the patient as a whole is outlined.
3. The mortality rate, in 200 patients 70 or more years of age having 230 abdominal operations at St. Luke's Hospital, Chicago, was 6.5 per cent.
   a) In elective surgery, the mortality rate was 4.8 per cent.
   b) In emergency surgery, the mortality rate was 9.3 per cent.
4. Cardiac disease and peripheral vascular accidents were responsible for 9 of the 13 deaths.
5. In our opinion, morbidity and mortality in the elderly patient can be reduced. The risk of surgery does not differ greatly from that in other age groups.

REFERENCES

1. Thompson, W. O.: Aging comes of age, *J. Am. Geriat. Soc.* **1:** 1–3 (Jan.) 1953.
2. Strohl, E. Lee: Pre-operative and post-operative care in elderly people, *Geriatrics* **8:** 377–384 (July) 1953.
3. Elman, Robert: Pre-operative transfusions in geriatric surgery, *A.M.A. Arch. Surg.* **65:** 805–807 (Dec.) 1952.
4. Haug, C. A., and Dale, W. A.: Major surgery in old people, *A.M.A. Arch. Surg.* **64:** 421–437 (Apr.) 1952.
5. Crump, Curtis: The incidence of gall stones and gall bladder disease, *Surg., Gynec. & Obst.* **53:** 447–455 (Oct.) 1931.

6. Strohl, E. Lee, and Diffenbaugh, W. G.: Acute cholecystitis, *Surg. Clin. North America* **32:** 63–70 (Feb.) 1952.
7. Ferguson, L. K.; Smith, D. C., and Houston, P. C.: Intestinal obstruction in the aged, *Geriatrics* **4:** 341–352, (Nov.–Dec.) 1949.
8. Strohl, E. Lee, and Sarver, F. E.: Acute appendicitis, *Arch. Surg.* **55:** 530–537 (Nov.) 1947.
9. Foldes, F. F.: Pre-operative preparation and post-operative care of the aged, *Geriatrics* **7:** 165–172 (May–June) 1952.
10. Strohl, E. Lee: Surgery of the aged, *Illinois M. J.* **80:** 369–373 (Nov.) 1941.
11. Culver, G. A.; Makel, H. P., and Beecher, H. K.: Frequency of aspiration of gastric contents by the lung during anesthesia and surgery, *Ann. Surg.* **133:** 289–292 (March) 1951.
12. Clark, J. H.; Nelson, Woodrow; Lyons, Champ; Mayerson, H. S., and De Camp, Paul: Chronic shock: the problem of reduced blood volume in chronically ill patient; concept of chronic shock; hemoglobin and red blood cell deficits in chronic shock: quantitative aspects of anemia associated with malignant tumors, *Ann. Surg.* **125:** 618–646 (May) 1947.
13. Beling, C. A.; Morton, T. V., Jr., and Bosch, D. T.: Blood volume and other determinations in pre-operative and post-operative care. Their practical applications in the average hospital, *Surg. Gynec. & Obst.* **87:** 163–171, (Aug.) 1948.
14. Beling, C. A.; Bosch, D. T., and Carter, O. B., Jr.: Blood volume in geriatric surgery, *Geriatrics* **7:** 179–183 (May–June) 1952.
15. Ryan, A. J.: Surgery in the patient over 70, *Ann. Int. Med.* **36:** 1431–1443 (June) 1952.
16. Moyer, C. A.: Acute temporary changes in renal function associated with major surgical procedures, *Surgery* **27:** 198–207 (Feb.) 1950.
17. Evans, E. I.: Potassium deficiency in surgical patients: its recognition and management, *Ann. Surg.* **131:** 945–959 (June) 1950.
18. Cole, W. H.: The need for greater accuracy in the determination of operability, *Surg., Gynec. & Obst.* **94:** 248–250 (Feb.) 1952.
19. Willius, F. A.: The heart in prostatic hypertrophy, *J. Urol.* **13:** 337–342 (March) 1925.
20. Litter, Julius: Thromboembolism: its prophylaxis and medical treatment, *Med. Clin. North America* **36:** 1–15 (Sept.) 1952.
21. Welch, C. S.: Surgery in the aged, *New England J. Med.* **238:** 821–832 (June 10) 1948.

MANAGEMENT OF PROSTATISM IN THE AGED

NORRIS J. HECKEL, M.D.*

The Department of Urology of the Presbyterian Hospital of Chicago, and the University of Illinois College of Medicine, Chicago, Illinois

Since life expectancy has increased tremendously in the last fifty years and since most diseases of the prostate gland occur in elderly men, it is obvious that the physician will be called upon to diagnose and treat an ever-increasing number of men who suffer from prostatic trouble.

Obstructions at or around the bladder neck can be divided into two general groups, namely, the benign lesions and the malignant diseases.

The most common benign lesion that causes obstruction in the aged is prostatic hyperplasia, *i.e.*, prostatic enlargement, or hypertrophy. These terms are synonymous for the same pathologic development.

BENIGN PROSTATIC HYPERTROPHY

Etiology

Many theories have been expounded to explain the occurrence of this condition. However all have been inadequate. The most recent theory, which is the so-called endocrine one, explains prostatic hypertrophy on the basis of an imbalance between the sex hormones. However, the only definite fact known about the cause of prostatic enlargement is that the symptoms develop in elderly men.

Pathology

The enlargement, or hyperplasia, may involve one or several lobes (Fig. 1). The disease is progressive and eventually residual urine, infection and bladder insufficiency occur. With the presence of residual urine, trabeculations of the bladder develop, followed by cellule formations, and not infrequently true diverticula. In the upper urinary tract the pathologic changes are as follows. There is first a gradual dilatation of the ureters and the pelves of the kidneys. This results in hydronephrotic atrophy with destruction of kidney substance, which is followed by renal insufficiency, uremia and eventually death.

Symptoms

It must be realized that the size of the obstruction may have no relation to the severity of the symptoms. The most common early symptoms of prostatic hyperplasia are nocturia, day frequency, hesitation and weak stream. Interference with the normal act of voiding may be gradual in its development, or it may be very sudden, with an acute retention of urine. When residual urine

Received for publication August 5, 1953.

* Read at the Annual Meeting of the American Geriatrics Society, New York, May 28-30, 1953.

occurs with its accompanying infection, the patient usually notices the general symptoms of fatigue, weakness, malaise and loss of appetite. As the disease progresses headaches, nausea, vomiting and the signs and symptoms of renal insufficiency are present. By this time, and even before, there is a secondary anemia. In the early phase of prostatic enlargement, sexual symptoms of persistent and painful nocturnal erection may be responsible for bringing the patient to the physician. On the other hand the sexual symptoms may be just the opposite, with loss of libido and various degrees of impotence. Hematospermia may occur.

FIG. 1. Prostatic hypertrophy involving the two lateral and middle lobes. Trabeculations of the bladder present.

Diagnosis

In the majority of patients the diagnosis of prostatic hypertrophy is relatively easy. The prostate is felt per rectum and it is enlarged and smooth, with the borders sharply defined. However, it must be remembered that an enlarged middle lobe, or a posterior commissure cannot be felt per rectum. In other words, all the various types of prostatic enlargement cannot be diagnosed by rectal examination. The next procedure, after the usual standard laboratory examinations, is the determination of the amount of residual urine. This must be carried out under the strictest aseptic conditions.

In order to evaluate the condition of the bladder and observe the type of enlargement that is present, a cystoscopic examination is necessary. In elderly people this should be performed in the hospital, preferably under pentothal

sodium anesthesia (if not contraindicated). Many urologists also insist that a cystogram be made, feeling that this will reveal a diverticulum that cannot be seen or is missed on cystoscopic examination.

Differential diagnosis

The three common diseases that must always be considered in the diagnosis of prostatic hypertrophy are stricture of the urethra, carcinoma of the prostate and the various neurologic diseases that cause a retention of urine. The symptoms of any one of these conditions, as far as the urinary tract is concerned, may be the same as those of an enlarged prostate.

FIG. 2. A large diverticulum of the bladder caused by an enlarged prostate gland.

The diagnosis of a urethral stricture is made by an examination of the urethra with sounds. In prostatic cancer the prostate is usually hard and nodular, with the borders of the gland not sharply defined. In very early prostatic cancer, however, the findings are entirely different and many times, in order to make a clear-cut diagnosis, a biopsy is necessary. In some instances it is very difficult to make an accurate evaluation of the cause of the residual urine in a patient who has a neurologic disease which is affecting the bladder along with some prostatic obstruction. This is especially true if the patient has a fibrosis or contracture of the bladder neck, instead of prostatic hypertrophy.

Associated pathology

If there is residual urine, infection resulting in cystitis is not uncommon. A diverticulum of the bladder (Fig. 2) and bladder stones occur frequently.

Treatment

The management of patients with prostatic enlargement can be discussed under two general headings, namely, medical and surgical.

Medical: Certainly not every man with an enlarged prostate need be operated upon. As a matter of fact, probably only about 25 per cent of hypertrophied prostates require surgical removal. We cannot subscribe to the so-called "prophylactic surgical prostatectomy." We have watched many men for years, who have an enlarged prostate with some of the symptoms of obstruction but very little residual urine. They have been carried along comfortably without the necessity of an operation. Since most patients with prostatic hypertrophy have an associated prostatitis, mild prostatic massage at not too frequent intervals, is beneficial. Also in the treatment of this group of patients, elimination of strong alcoholic beverages and highly seasoned foods will often decrease the amount of day frequency and nocturia. It is questionable whether hormones are of any value—certainly not male sex hormones. Although estrogens will produce definite degenerative changes in the glandular structure of the hyperplastic prostate, it is questionable whether the gland is sufficiently decreased in size to give much relief from the obstruction.

Surgical: The patients who require surgery are those in whom the enlarged prostate is associated with a bladder insufficiency. The surgical removal of the hypertrophied prostate can be carried out by one of four methods, namely, transurethral resection, suprapubic prostatectomy, retropubic prostatectomy, or perineal prostatectomy. Each method has its advantages and there are differences of opinion about the merits of the various procedures. Many agree that very large prostates are best removed by open surgery. A good rule to follow is to choose the operation best suited for a given patient, rather than to make the patient fit a certain procedure. Equally as important as the type of operation is the proper preparation of the patient for surgery. Here the important problem is to put the patient in the best possible condition before any type of operation is considered. If renal insufficiency and infection are present, this should be treated by proper drainage of the bladder, either by an indwelling urethral catheter or by suprapubic cystotomy. Anemia, if present, must be corrected. Since many of the patients have previously had a coronary thrombosis, a proper evaluation of the heart is in order. A prostatectomy is never an emergency procedure. It is better to wait too long than to operate too soon.

PROSTATIC CANCER

According to statisticians, this is the most common site of cancer in the male.

Etiology

The etiology of prostatic cancer is unknown. Great advancements, primarily as a result of the investigations of Huggins and his associates, have been made, especially concerning the relationship of the endocrine system to this disease. For instance, they have shown that some types of prostatic cancer are sensitive

to the presence of androgen or male sex hormone in the body, and that this hormone activates the growth of the cancer cells. They have also shown (1) that the inactivation of the hormone will bring about a retrogression of the cancer cells. This can be accomplished in several ways: 1) by eliminating the principal source of the androgen (in the testes) by castration, 2) by the administration of estrogens, 3) by a combination of both types of therapy, namely, castration and estrogen therapy, and 4) total bilateral adrenalectomy. This latter form of treatment has been carried out mostly on the so-called "doomed" patients suffering from cancer of the prostate, *i.e.*, those who had received all the other forms of therapy but showed little or no clinical improvement.

Symptoms

Prostatic cancer, like many other cancers, is a silent and symptomless disease. It is only when the signs and symptoms of urinary retention develop or the signs caused by metastases appear, that the patient consults the physician. By this time the complaints are usually difficulty in emptying the bladder and hematuria. Since many patients already have metastases, backache, lumbago and sciatica are the chief complaints; loss of weight and appetite, fatigue and anemia are usually present.

Diagnosis

The diagnosis of prostatic cancer in the majority of patients is easy to make. There are very few diseases of the prostate that produce similar rectal findings. The prostate, either in part or all, is stony hard and nodular. This may extend out beyond the borders of the gland. On the other hand, the diagnosis of early prostatic cancer may be difficult and the decision can only be made after a biopsy. Just how much aid is obtained in the diagnosis of prostatic cancer from the determination of the serum acid and alkaline phosphatase levels is open to question. Other diseases can cause an increase in these enzymes. In highly undifferentiated prostatic cancer the serum acid phosphatase level may be normal, even with extensive metastases.

Treatment

It is unanimously agreed that early prostatic cancer is best treated by radical perineal prostatectomy. However, the percentage of patients who come to the physician with early cancer of the prostate is so small that, unfortunately, the treatment of prostatic cancer in general is the treatment of advanced prostatic cancer. Before the investigation of Huggins, little improvement was obtained for the patient with any type of therapy. Enough time has now elapsed to appraise the so-called endocrine form of therapy. It is the consensus (2) that although this type of therapy is superior to all other previous forms of therapy, the beneficial results are not universal and the degree of improvement and duration of relief are variable; and that eventually a majority of patients experience a relapse and die of the disease. In a recent report, Huggins and Bergen-

stal (1) have observed that when antiandrogenic treatment is used in cancer of the prostate the results fall into three categories: 1) no effect upon the cancer, 2) retrogression of the primary neoplasm and its metastases, and 3) retrogression of the primary neoplasm, with progression of metastases. Huggins is also of the opinion that when cancer cells have lost many of the qualities of the normal prostatic epithelium, their metabolism is self-regulating and therefore cannot be influenced by hormonal therapy. He also has demonstrated that certain mammary cancers as well as prostatic cancers are dependent upon the function of the adrenal gland and that some patients with widespread metastases experience an amelioration of the disease after total bilateral adrenalectomy. However, many such patients are not so benefited.

It should be emphasized that before an attempt is made to remove the patient's adrenals, adequate hospital facilities are necessary to prepare the patient for this procedure as well as for the management of the patient afterwards. It will do little good to treat a patient with prostatic cancer who has a bladder insufficiency with any of the forms of endocrine therapy, and not remove the obstruction at the bladder neck. This can best be accomplished by transurethral resection.

There are still many unsolved facets to the problem of prostatic cancer. However, the recent progress that has been made in the management of this disease has given patients a longer and more comfortable span of life.

CONCLUSIONS

1. The two most common diseases of the prostate gland in the aged are prostatic hypertrophy and prostatic cancer.

2. Surgical removal of all hypertrophied prostates is not necessary.

3. The mortality rate from the surgical correction of prostatic hyperplasia has been greatly decreased as a result of better preoperative and postoperative management of the patients. The management of urinary tract infections has been improved by the use of the newer antibiotics.

4. The treatment of advanced prostatic cancer has been completely changed by the application of endocrine therapy.

5. As a result of these facts, elderly men with prostatic obstruction from any cause can be relieved of their symptoms with a greater degree of safety.

REFERENCES

1. Huggins, C., and Bergenstal, D.: Inhibition of human mammary and prostatic cancer, *Cancer Res.* **12:** 141, 1952.

2. Nesbit, R. M., and Baum, W. C.: Endocrine control of prostatic carcinoma, *J.A.M.A.* **143:** 1317, 1950.

PSYCHO-PHYSICAL COMPENSATORY ADJUSTMENTS IN THE AGED*

EDWARD B. ALLEN, M.D. AND HOLLIS E. CLOW, M.D.

The New York Hospital, Westchester Division, White Plains, N. Y.

The purpose of this presentation is to be pragmatic and to point out that health is never fortuitous, but the result of thought, conservation of resources and energy, and the avoidance, as far as humanly possible of what is disadvantageous. Riese (1) has pointed out that compensation is involuntary in nature. He made systematic attempts to train patients, affected with disorders of their co-ordinating mechanisms, in compensating by voluntary and conscious action for the deviations of their past-pointing fingers. There was no permanent result, but he found that frontal lesions were somewhat more changeable than cerebellar ones. He was dealing with compensations in terms of nervous function. Compensation may be considered as a way of life adapted by conscious decision and endeavor, or it may be a function accomplished by that self-regulated biologic whole that has to be considered when studying the organism as a subject of natural science.

Compensatory adjustments imply, in the broadest sense, making amends or making up for loss. The compensatory character of these adjustments is the result of the influence of both internal and external stimuli and they arise in response to the needs for relief which are the result of a close interweaving of both physiologic and psychologic tensions which can never be divorced. The psychologic tensions manifest themselves at a higher personality level of integration than the physiologic tensions, but there is never the one unaccompanied by the other.

The psychologic tensions manifest themselves generally in relation to external conflicts and frustrations which are the result of interpersonal or social relationships. These are revealed in the emotional field of the personality and characterize the nature of the thinking. They are accompanied, however, by a certain amount of physiologic tension, which is chiefly visceral and muscular. The physiologic tensions may have an apparent primary etiology from within, the result of infection, toxins, hemorrhages, tumor formation or unrecognized atrophic and degenerative processes, as well as endocrine and enzyme dysfunctions. But all of these disturbances of physiologic function may have been precipitated by some unknown external factor which has thwarted the instinctive drive or disrupted the emotional balance of the individual.

Perfect health in terms of compensatory adjustments, admittedly unattainable, but approachable, is the state of being in which all functional capacities of the organism are at the maximum which can be expected for the

Received for publication May 29, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28-30, 1953.

species. This obtainable optimum will be limited by hereditary endowment, prior experiences, environmental influences, therapeutic limitations, and the unavoidable consequences of age. Although the compensatory readjustments may appear at first to be the result of conscious motivations, further study will reveal that both in quantity and in quality, they will display a certain involuntary trend which inevitably is repetitious in character and revealing of the basic personality structure. By the time we are aware of these adjustments, they are the result of what has previously occurred. The past will also characterize their quality and response in the future. As Aristotle in his Politics proclaims: "Here and elsewhere we shall not obtain the best insight into things until we actually see them growing from the beginning."

It is obvious that the compensatory adjustments of the shy, withdrawn, sensitive, shut-in, and introverted, sedentary individual will be vastly different from those of the dynamic, vigorous, go-getting, traveling man of the world. The compensations of adjustment in the philosopher will necessarily differ from those of the artist, and those of the physician from those of the lawyer.

The compensatory adjustments with which the physician will have to deal fall into two large groups. First will be those adjustments, which the patient has been able to achieve through his own efforts and in terms of his own personality and, second, those adjustments which he can become aware of and utilize through the efforts of others. The physician will do all he can to preserve the first, if they are constructive in character, or to alter them if they have a deleterious effect upon the patient. The second type of adjustment necessitates even greater tact, skill and knowledge on the part of the physician. He should know the life history of his patient, and not simply recall the organic diseases and operations to which the latter has fallen victim. He should have a certain amount of psychiatric insight not to project his own enthusiasms and interests to the extent of expecting that the satisfactory adjustments which he personally has made and which have given him gratifying compensation with advancing years, will be suitable for the members of his aging or aged clientele. The physician must also remember that each decade in the life of the person he treats will have an influence on the adjustments to be made and that the compensations must be, within certain limits, comparable to those of a similar age group.

THERAPEUTIC CONSIDERATIONS

Although it is not the purpose of this paper to consider the details of treatment, certain broad and general concepts must be kept in mind by the physician in seeking to effect compensatory adjustments in the aged. These adjustments are both involuntary (automatic) and voluntary. A sharp distinction cannot be made but the preponderance of the involuntary adjustments will be physiologic and, as far as can be determined, the voluntary adjustments will be chiefly psychologic in character.

It soon becomes apparent that the treatment of persons who are advanced in years must be skillfully directed to the producing of a state of physical and psychologic homeostasis. Cannon (2) has called our attention to the physiologic

homeostatic processes such as body temperature, the regulations of blood sugar concentration and the acid-base relation. Homeostasis is preserved in the aged. According to Kountz and Chieffi (3) the one physiologic constant which does change with age is the basal metabolic rate. What is important is that the effectiveness of the other physiologic factors which preserve stability is impaired. The homeostatic processes are preserved within a narrow range in the aged and it takes little alteration in their accustomed habits to throw these processes out of equilibrium. It is also more difficult than in those of young years, once these equalizing processes have been thrown out of balance, to re-establish them into a harmoniously functioning unit again. A diseased organ cannot be treated too radically without thought of the collateral consequence in other organs. A dosage of digitalis which could be easily tolerated in the young, with benefit to the heart, may cause toxic delirium in the aged, who do not have as flexible an adaptive mechanism to ward off the toxic effects. This is also true of many other drugs, such as the barbiturates and morphine with its numerous derivatives.

The reduction of thyroid function which has been shown to occur often in the aging, results in a lowered metabolism and is reflected in a corresponding reduction of bodily physiologic response. The clinical use of desiccated thyroid may be of value in carefully selected cases, but more often it is to be avoided in the aged person, since its use appears frequently to incite coronary spasm with pain, due to the inability of sclerotic coronary vessels to withstand this added stimulation to the cardiac muscle. The discomfort and anxiety arising from such distress is most disconcerting to emotional composure.

In this study attention has also been given to the psychologic homeostatic mechanisms which operate to establish and preserve an intellectual and emotional equilibrium in the individual, in spite of the morphologic and physiologic alterations attendant on aging. These alterations pertain to all of the tissues, organs and systems of the body and to their integration.

It should be noted that compensatory mechanisms do not always produce satisfactory states of adjustment. The compensatory psychologic mechanisms may be more easily discerned, although they may be ineffectual and therefore result in physical or mental disorder. Hence personality disorders (including psychoses) may arise, which may not be socially acceptable, but may represent the best compromise or defense available to the individual against the pressures of reality.

Among the common psychologic adaptive mechanisms are those associated with the restriction of physical activity, in keeping with an increasing diminution of physical energy, loss of muscular strength, brittleness of bones, slower reflexes, arteriosclerosis and loss of general physical resiliency. These manifestations develop earlier in life and more rapidly in some persons and later in life and more slowly in others. With reduction in physical activity many compensatory satisfactions are obtained in intellectual and cultural pursuits.

The intellectual capacity does not necessarily decline along with physical deterioration; it permits compensatory satisfactions to be made out of past

experience or, deliberately, in response to new stimuli. Although certain aspects of intelligence, such as speed in comprehension, have been found to show a decrement with aging, other factors, such as skill and accumulated and organized knowledge, have been suggested by Miles (4) as possibly holding intellectual levels near peak performance for an indefinite time.

Clinical observation shows that many older people are able to maintain and extend their interests and also to function very well emotionally and intellectually at an advanced age, when their interests and motivations are strong. Generally there is a fairly even balance between the needs which a person feels for physical or intellectual expression and his ability to achieve satisfaction so that a condition of homeostasis, felt as emotional equanimity, is present.

Modifications of drives in relation to aging allow people to spare reduced physical capacities and to protect the organism against over-exertion. Those who have enjoyed athletics become satisfied to obtain vicarious pleasure by watching rather than by participating in athletic events, or they may amuse themselves by becoming devotées of croquet or shuffleboard. A life-long enjoyment of fishing may now find fulfillment as their chief out-door pastime.

Certain personality traits are common in the aging person. As he grows older he is likely to become more conservative, even to the point of being rigid. The definite patterns that he follows under ordinary circumstances make life easier for him. He likes to keep within limits which do not require the effort contingent on change. In the elderly, this rigidity may, of course, not represent solely a defense adaptation to reduce effort. It may be found in younger persons as a psychologic defense mechanism to avoid anxiety and may also be due to training and deliberately-learned patterns which had seemed to increase efficiency in adult life. When rigidity is present in a young person, it is likely to be doubly accentuated in his old age.

The older person can, however, train himself in mental elasticity as well as rigidity and many examples of this are seen clinically. Furthermore, the elaboration of ideas does not require much physical effort. Youth is the time for expending physical and mental energies, adult life is the time for channeling them, and old age is the time to conserve physical energy but to extend mental horizons. Cautiousness is another trait frequently found in older people who wish to conserve and protect what they have, because of their lessened vigor to pursue new enterprises.

Often attempts at adaptation may be inadequate, uneven or excessive, resulting in a state of physical or psychologic malfunction. Failure of protective psychologic mechanisms may result in physical over-exertion, perhaps with failure of a heart which otherwise would have functioned adequately. Too marked psychologic defenses of projection, withdrawal or over-compensatory emotional pressure may lead to neurotic, paranoid, depressive or manic states. Excessive emotional reaction or a less philosophical attitude toward worry may even precipitate an organic type of psychosis in patients with cerebral arteriosclerosis, whose mental ability may be adequate but with a narrow range of

adaptability. The psychiatric aspect of this problem will be developed subsequently in this article.

DISCUSSION

The adjustments of a compensatory nature which an individual can make through his own efforts may give evidence of his being ill, to the extent of needing to alter his way of life, but the fact that he recognizes the need and acts upon it before seeking the services of the medical profession hardly justify classifying him as a patient. It might be argued that such insight as this should be inculcated in the young during their period of formal education. Such insight, however, depends upon the vigor, resourcefulness, powers of observation and ability to profit from the experience of the individual instead of upon what is purposefully imparted to him by his mentors and associates. Insight is innate rather than acquired and often the result of latent or unconscious influences of which the possessor may never become fully aware. As illustrative of this, we have Demosthenes, who could compose better than he could speak. He was physically weak and defective in articulation. To overcome such impediments he addressed the sea with a mouth full of pebbles, or declaimed as he ran up a hill. Such persistency of effort enabled him to become convincing in discourse. Dostoevsky capitalized upon his epileptic attacks, to arise as soon as they were over and write out his subjective impressions and experiences that remain a lasting tribute to his intellectual honesty and genius. Toulouse-Lautrec, doubtless an achondroplasic with shortened and deformed lower limbs, the result of fractures in his youth, was compelled to walk with a cane and was precluded from dancing in the cafes and concert halls of Paris which he loved to frequent. But as a careful observer, he used his eyes and hands to depict that atmosphere in such color and caricature that his paintings and posters hold positions of honor in the Louvre and other museums throughout the world.

Our creative writers are said by Somerset Maugham to be lonely, but they are intensely observant and compensate with a compulsive drive that is often painfully exacting but rewarding in achieving recognition. They give adequate testimony to successful sublimation through creative effort.

The second group of compensatory adjustments, those which the patient can become aware of and utilize through the efforts of others, focus attention more directly upon the problems of those already aged. The first group, those which the individual puts into effect through a compulsive inner drive, deal more directly with the aging.

The aged are to be considered as those who are in the throes of the involutional period, beset with fears of the future, and of necessary change in their accustomed and conditioned adjustments to life. They are patients who are in need of help. Those individuals, who with foresight and philosophic complacency follow a charted course between the Scylla of emotional conflicts and the Charybdis of physical or constitutional inadequacies, are fortunate. They serve as a standard by which the physician may test his therapeutic efforts with those less adequate.

The following case reports deal with patients at the involutional period when the functional character of their illness still plays an important role and enables the physician to be of assistance in effecting helpful compensations. They are in contrast to those patients who are so handicapped by their organic pathologic conditions that therapy becomes inevitably a matter of mere custodial care.

Case 1.

This case illustrates how a patient confused with the toxic effects of alcohol and further handicapped by cerebral vascular disease may have his fears allayed and his convalescence hastened, not only by proper medical treatment but also by attention to, and the facilitation of any compensatory adjustments which are possible in bringing him again into social articulation with his environment.

A married man of 63, an aggressive, driving, successful business man, with no hobbies' who had frequently stated, "I can never retire," was operated upon in 1948 for detached retina of the right eye, sustained as a result of an accidental blow on the head. Following surgery, he was blind in the eye. In the immediately postoperative period he required much sedation. On his return to work, he increased his consumption of alcoholic beverages and as a result became more tense and confused.

For six months before his presenting illness he had been noticeably slower in his work, often forgetful and in February 1951, his blood pressure was recorded as 200 systolic over 100 diastolic. He became even more forgetful; also evasive and restless. He went out to buy a stock of liquor, with plenty in the house. That night he played cards with his family until 2 A.M., and had a delightful time. On awaking the next morning, he suddenly announced, "I am off drinking for a week." In the afternoon, without apparent loss of consciousness, there was sudden development of a left-sided weakness with a sagging mouth, but the patient remained ambulatory. On arrival at a general hospital shortly after, his speech was mumbling and slurred, his gait was halting and he was disoriented as to time and place. There were extenuating circumstances and proper compensations were overlooked. He justifiably had fears of being doped, as he was given much sedative medication, often intramuscularly, with a large syringe which he could personally observe. His poor perception of his whereabouts was increased by not being allowed the use of his spectacles, even under close supervision. He did not know where his room was and protested it was changed. This was noted as a delusion, in spite of the fact that he frequently awoke in a new room as he had been disturbed in the former one. Most of the nurses attempted to restrain his leaving his room or wandering down the corridor. They became angry; he became irritated and feelings of hostility arose. But one nurse allowed him to wander about under supervision and inspect the linen closet. They soon became friends. He continued to be domineering with the others, suspicious and confused by sedation.

Ten days later he was transferred to the New York Hospital—Westchester Division, a mental hospital. The only sedation he received was paraldehyde (2 drams) the first two nights after admission, which produced adequate sleep. He was confused on admission, but was allowed his spectacles during the day, so he could more accurately determine his whereabouts. The evening of admission he was able to perceive that the hall door was locked. Concerned about the rules, he protested he couldn't have "a damn thing." However, he was well accepted by the other patients, was able to walk about unaided, and was allowed to go where he wished in the closed hall. The next morning when he wished to leave, he was easily persuaded to wait until he could see his doctor. He was intermittently confused at first, but within three days he was able to find his room without difficulty, was mentally clear within a week and prompt for all routine activities within ten days.

It was soon evident he had been a dynamic leader, genial underneath, but inclined to bluster on the surface. He had been a boss, who understood firm but just commands. When

given a direct, "No," in reply to a request, he would exclaim, "Okay, I have been a boss myself and I can take it." He was allowed to have some say in his future plans and within two months was back at work, where he attended three board meetings. At first he commuted to town daily, but he was allowed to sever his connections with the hospital two and a half months after admission.

Understanding his personality, stimulating a feeling he could be trusted and allowing him to make some decisions for himself quickly relieved his feelings of anxiety and frustration. Attention to details, and the permission of compensations in his adjustment certainly facilitated and speeded his recovery.

Case 2.

This case illustrates how a person, through mental hospital residence, can learn to manage better and, on returning home, can be helped by having a responsibility to meet which is within his limitations but sufficient to enable him to think of someone else besides himself. It also discloses the difficulties that may arise in evaluating the emotional factors in a case of psychosis with cerebral arteriosclerosis, but how attention to them may offer satisfactory compensations for adjustment.

A married man of 55, a fruit farmer, entered the New York Hospital—Westchester Division, because of a depression of psychotic proportions. Many relatives had had marked personality inadequacies. The patient was too nervous to advance in school and left at the age of 13 to go to work. His nervousness was easily aggravated in the presence of others or under stress. Most of his life he was a seclusive farm hand. He worked hard to dissipate his tension, but this did not prevent his becoming assaultive on one occasion with his father, with whom he frequently argued. His only recreations were hunting and trapping. He neither smoked nor drank. His marriage, at 32, to a children's maid four years his senior, was childless. Four years later he was able to buy his own farm. Unstable and excitable, he managed to stay within bounds until five years before this hospital admission, when he had his first psychotic reaction—a depression of a week's duration, the result of his concern over a frost which damaged his fruit trees. Subsequently, he had become in turn depressively agitated and overactively excited. He sold his farm and after completing the transaction regretted it, had an agitated depression and went to a hospital for ten days. He left dissatisfied, and on his return home was abusive, unmanageable, threatened his wife, and spoke of self-injury. He soon entered another period of agitated depression and re-entered the hospital. He was of pyknic habitus, tremulous, with a blood pressure of 130 systolic over 80 diastolic. The neurologic examination, including eye-grounds, gave negative results, as did all laboratory tests. Although cooperative and not confused, he was easily irritated and close to tears when discussing his difficulties. He complained of tinnitus, but ear, nose and throat examinations revealed nothing abnormal. On admission, because of his marked emotional lability, his alternating depressions and periods of excitement, his clear sensorium with an alertness to his environment, and a lack of any objective evidence of arteriosclerosis, cerebral or otherwise, he was looked upon as having a manic-depressive psychosis—that is, a functional emotional illness. Soon other factors manifested themselves which did not seem consistent with such a diagnosis. A careful check-up of his history revealed that a physician who had treated him over the previous five years had looked upon his symptomatology as that of a psychosis associated with cerebral arteriosclerosis. His friends reported that his condition had been developing for several years associated with actions different from his previous behavior. The patient admitted that, previously, when excited he had become confused and bewildered. In the hospital, when questioned suddenly, he would hesitate and have difficulty answering correctly. His tinnitus continued. He showed marked childish emotionality and under suggestion could be stimulated to weep, to chuckle or to become irritated.

Psychologic tests were helpful in the differential diagnosis. At the time of admission to the hospital the only one given was a parotid test which, by checking and estimating the flow of saliva from the parotid gland over a stated period of time, indicated a manic-depressive type of reaction. Three and a half months later, however, a complete battery of psychologic tests was given the patient, including the Wechsler-Bellevue Intelligence Scale, the Wechsler Memory Scale, the Weigl Sorting test and the Rorschach test. All of these showed evidence of organic impairment, which was definite but not marked. The most pronounced deficiencies were in recent learning, abstract reasoning and immediate recall. A second parotid test at this time indicated that the original secretory level, indicative of manic-depressive depression, no longer was present.

Further observation indicated that the patient was garrulous, tended to reminisce, to be repetitive, to be vague and rambling and to lack detail in what he narrated. When these added factors were properly evaluated, it seemed advisable to classify this patient as one suffering from a psychosis with cerebral arteriosclerosis. It should also be noted that there had been no history of definitely circumscribed emotional psychotic episodes at any period in the patient's life up to the previous five years.

The patient left the hospital after three months' residence, against advice. In the protected environment of the hospital, under a carefully supervised regimen, his condition was much improved.

Five years later a letter was received from the patient's wife, in response to an inquiry. She reported that it took him about a year after leaving the hospital, to be like himself. She thought his improvement was related to her severe illness. At the time she wrote the letter, he was cultivating four acres of currants, which kept him busy, as well as raising a few turkeys and chickens; he also obtained much pleasure out of two hunting dogs. He was no longer quarrelsome.

The patient had learned during his hospital residence to manage better and control his temper with others and, on leaving, to live within his limitations in an environment that was quiet and free from undue stimuli. He had carefully avoided upsetting business transactions. Unlike the first patient, in whom compensations of adjustment were made in the hospital for the patient in accordance with his personality, this patient was given an opportunity to figure out things for himself and through experience to learn that his salvation lay in daily employment, at first in caring for a sick wife and later in his farming. This released his tensions, as it had previously, before he became ill.

SUMMARY

Health is never fortuitous. Compensation may be considered as a way of life adapted by conscious decision and endeavor, or it may be a function performed by that self-regulated biologic whole that has to be considered when studying the organism as a subject of natural science.

Compensatory adjustments imply, in the broadest sense, making amends or making up for loss. The compensatory character of these adjustments is the result of the influence of both internal and external stimuli. The adjustments arise in response to the needs for relief, which are the result of a close interweaving of both physiologic and psychologic tensions which are never to be divorced.

The psychologic tensions manifest themselves generally in relation to external conflicts and frustrations which are the result of interpersonal or social relationships. They are accompanied, however, by a certain amount of physiologic tension, which is chiefly visceral or muscular. The physiologic tensions may have an apparent primary etiology from within, but they are more likely to have

been precipitated by some unknown external factor which has thwarted the instinctive drive or disrupted the emotional balance of the individual.

The compensatory adjustments with which the physician will have to deal fall into two large groups. First will be those adjustments which the patient has been able to achieve through his own efforts and in terms of his own personality; and second, those adjustments which the patient can become aware of and utilize through the efforts of others. The physician must preserve the constructive character of the first and use his art, tact and skill in trying to effect the second.

The adjustments are both involuntary (automatic) and voluntary. Treatment of persons advanced in years must be skillfully directed to the production of a state of physical and psychologic homeostasis. It must recognize that homeostasis is preserved in the aged, except for the physiologic constant of basal metabolism, but that the stability of this homeostasis is impaired and is preserved only within a narrow range. It takes little alteration in the accustomed habits of the aged to throw it out of balance, and it is much more difficult than in younger years to re-establish homeostasis. We should strive to maintain what has been preserved in the aged, to avoid over-compensation, and to promote greater stability in cases of under-compensation.

REFERENCES

1. Riese, W.: The principle of compensation of nervous function, *J. Nerv. & Ment. Dis.* **100:** 263 (Sept.) 1944.
2. Cannon, W. B.: Ageing of homeostatic mechanisms, *in* Problems of Ageing, ed. 2, edited by E. V. Cowdry. Baltimore, Williams & Wilkins Co., 1942, pp. 569–570.
3. Kountz, W. B., and Chieffi, M.: General oxidative processes with relation to degenerative changes in the body, *Geriatrics* **2:** 344 (Nov.–Dec.) 1947.
4. Miles, C. C.: The influence of speed and age on intelligence scores of adults, *J. Gen. Psychol.* **10:** 208 (Jan.) 1934.

SUBDURAL ADMINISTRATION OF HYDROCORTISONE IN MULTIPLE SCLEROSIS: EFFECT OF ACTH

GEORGE F. KAMEN, M.D. AND GEORGE L. ERDMAN, M.D.

Department of Clinical Investigation, Overlook Hospital, Summit, N. J.

This paper deals with a preliminary investigation on the effects of combined subdural administration of hydrocortisone (as free alcohol) and deep subcutaneous administration of ACTH in a patient with a multiple sclerosis syndrome of fifteen years' duration. At the time of writing, the patient has been out of the hospital and followed weekly in the Out-patient Department for only six weeks. Results of treatment have been so encouraging as to merit mention but any inferences which may be drawn are to be considered only tentative.

Short-term use of corticotropin or adrenal steroids administered orally or parenterally for treatment of degenerative and inflammatory pathologic processes of the central nervous system may have beneficial results in certain instances. However, the benefit after long-term high-dosage therapy, is expensive metabolically to the patient and associated with the undesirable development of one or more signs of adrenocortical overactivity. An adequate explanation of this chain of events is wanting.

Findings obtained by current methods of evaluation in no way suggest exhaustion or underfunction of the adrenal cortex in untreated multiple sclerosis. The internal hormonal balance between the pituitary (adrenocorticotropin) and the adrenal cortex (adrenocorticoids) may be considered intact. Though the quantity of adrenocorticoids appears to be adequate for pituitary-adrenocortical balance, a disturbance in distribution is suggested. Either the corticoids are not gaining entrance to the nerve tissue and spinal fluid, or the quantities of the effective anti-inflammatory steroids that do get in, are insufficient to affect noticeably the underlying pathologic process. Their non-appearance in nerve tissue may be explained on the basis of possible selective filtration of steroids and the presence of a high threshold level at the choroid plexus or nerve tissue-vascular barrier. Inadequacy of concentration may be explained on the basis of non-nervous system tissue competition for the anti-inflammatory steroids. There is also the possibility that adequate therapeutic amounts of anti-inflammatory corticoids gain entrance to the nervous system but are quickly degraded chemically to pharmacologically inactive compounds. Any one of the foregoing conditions can account for continuation and progression of the underlying pathologic process in the nervous system in active untreated multiple sclerosis.

It is interesting to note that normally there is a marked discrepancy between the concentrations of cholesterol in the blood and in the spinal fluid, which would indicate a threshold level, or selective filtration of cholesterol or chemically related substances (steroids).

In multiple sclerosis the parenteral administration of corticotropin or adreno-

Received for publication July 18, 1953.

corticoids, alone or in combination, cannot be considered replacement or maintenance therapy, because of lack of evidence for hypofunction of the adrenal cortex. Normally the internal hormonal environment is maintained in equilibrium. Both quantity and distribution of the hormones are carefully regulated and deviations from the normal are combated. Administration of small doses of corticoids, sufficient to elevate the blood corticoid level slightly, are probably detoxified (tissue competition) before they have an opportunity to exert their physiologic effect. Large doses over a prolonged period of time, however, raise the blood levels significantly. A possible explanation for a therapeutic response is that the nervous system threshold level for corticoids is exceeded and thus adequate amounts of the corticoids gain entrance to the nervous tissue and spinal fluid. However, the excess corticoids may disturb the internal hormonal environment and bring about the undesirable development of one or more of the signs of adrenocortical overfunction.

Although the causative factor for multiple sclerosis remains unknown, evidence of a therapeutic response to adrenal corticoids indirectly suggests the underlying pathologic process to be an inflammatory type of reaction, possibly on an allergic basis. The transient beneficial results obtained following treatment further suggest that adrenal corticoids can control somewhat the pathologic reaction in nerve tissue only to a limited extent, and possibly have no direct effect on the causative factor. Prolonged remissions following treatment suggest the possibility that adrenal corticoids can adequately control the allergic inflammatory reaction which may be the cause of tissue damage, and also free the inhibited normal humoral and phagocytic defense mechanisms of the body to overcome and control the irritant or causative factor of multiple sclerosis.

Subdural administration of the chemically free and uncombined alcohol of hydrocortisone seemed to be a rational and direct way of obtaining the necessary effective local anti-inflammatory steroid levels in the spinal fluid and nervous system. Hydrocortisone appeared to be about the best known local anti-inflammatory agent and it was thought that its local use in the nervous system should not greatly disturb the metabolic economy of the body or bring about the undesirable signs of adrenocortical overfunction. With this concept in mind, it was decided to determine what effect subdural administration of hydrocortisone would have on the underlying pathologic process in the nervous system in multiple sclerosis.

METHODS

Table 1 shows a summary of the diet, type of medication, dose, and date of administration. Criteria of improvement were based on objective features of the clinical neurologic examination and subjective evaluation.

Hydrocortisone: There was no set plan for the administration of hydrocortisone. The quantity was limited and the effective dose unknown. At 8:00 A.M. for six consecutive mornings from March 16 to March 21, and on April 1, 1953, the patient was placed on his right side; under sterile conditions, with 1–2 per cent local procaine anesthesia, the subdural space was entered. Placing of the spinal

TABLE 1
Medication

Medication	Total daily dose																															
Hydrocortisone (mg.)			10		20		10		40		20														20							
ACTH—total U.S.P. units in 24 hrs./divided dose									20/1		20/1		30/2		45/3		45/3		45/3		45/3		40/2		40/2		40/1		40/1		20/1		10/1
Potassium chloride (Gm.)											2		6		6		6		6		6		6		6		6		4		3		1.5
l-Thyroxine sodium (mg.)															0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1		0.1	
Multiple vitamins (capsules)																	3		3		3		3		3		3		3		3	
Oxytetracycline (Gm.)																	0.5		0.5		0.5											
Calcium (tablets)																							1		2		2		2		2	
Aspirin (Gm.)					0.6				1.2										0.6													
Diet	Regular house diet									2000 cal.—salt-free									3000 cal., high prot., mod. fat & carbohyd., salt-free													
Date	March																												April			
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4										

needle varied each day, but was limited to the lumbar region. Pressure was recorded and 10 milliliters of spinal fluid removed for laboratory examination.

With a 5-milliliter syringe having an off-center adapter, hydrocortisone crystals[1] suspended in physiologic salt solution and previously warmed to body temperature were injected slowly. With the syringe in place, spinal fluid was then withdrawn and re-injected slowly and gently three times, in order to wash out the remaining crystals in the syringe completely and to insure mixing of the crystals with spinal fluid. The patient was placed in the supine position and the head was lowered approximately thirty degrees to permit cephalad gravitation of the crystals. Periodically, the position was changed from supine to prone. After an observation period of one hour, the patient was sent back to bed. At no time was there any subjective or objective evidence of toxicity or adverse reaction to the injected hydrocortisone. There was, however, a mild dull mid-frontal headache, present only on sitting up, which started on the second day of treatment and continued for a week. It is interesting to note that, with the exception of the first two days, headache was associated with a spinal fluid pressure reading of zero.

Adrenocorticotropic hormone Acthar Gel—H.P. (Armour): Since intrathecal hydrocortisone showed evidence of therapeutic effectiveness and the supply of material was limited, ACTH in relatively small doses was administered for the purpose of studying the effects of ACTH on the results obtained with hydrocortisone.

Beginning at 10:00 P.M. on March 19, 1953, and continuing up to and including the day of discharge on April 4, Acthar Gel was administered by deep subcutaneous injection in single or divided doses. There was no dramatic clinical improvement at any time during ACTH therapy. Qualitative or quantitative studies on the function of the adrenal cortex during the course of this study were not made.

Potassium chloride (enteric-coated tablets, 0.324 gram per tablet): A dose of approximately 6.0 grams daily was necessary for potassium balance.

Levo-rotatory crystalline thyroxine sodium ("Elthrin," Smith-Kline and French): Tablets containing 0.1 milligram of *l*-thyroxine-sodium were given at 8:00 A.M. daily starting March 21, 1953, and were continued following discharge from the hospital (see section on "Laboratory results").

Multiple vitamins ("Theragran," Squibb): Each capsule contained vitamin A (synthetic), 23,000 U.S.P. units; vitamin D, 1,000 U.S.P. units; thiamine mononitrate, 10 milligrams; riboflavin, 5 milligrams; niacinamide, 150 milligrams; and ascorbic acid, 150 milligrams. The patient received one capsule three times a day beginning March 24, 1953, and also following discharge from the hospital.

Calcium ("Calscorbate," Cole Chemical Company): Each tablet contained calcium ascorbate, 30 milligrams; dicalcium phosphate, 1.08 gram; and vitamin

[1] Hydrocortisone (Schering)—glass ampuls each containing 20.0 mg. of microcrystals of hydrocortisone (free alcohol) suspended in 1.0 ml. of physiologic sodium chloride. Preservatives, emulsifying or suspending agents were omitted in order to avoid possible toxic reactions.

D_2 (calciferol), 800 U.S.P. units. One tablet was dissolved slowly in the mouth morning and evening, starting March 29, 1953, and was continued daily following discharge from the hospital.

Aspirin: Small doses on three occasions for the headache had little or no beneficial effect.

Oxytetracycline hydrochloride ("Terramycin," Chas. Pfizer & Co.): For a mild gingivitis, two 250-mg. capsules were administered orally every six hours for four days.

Diet: The daily diet contained 3000 calories; it was low in salt, high in protein, and moderate in fat and carbohydrate. Dairy products as well as high-carbohydrate foods such as candy, were not permitted. Fluid intake was limited to 1500 ml. per day.

CASE REPORT

The history of this volunteer, 39-year-old white man revealed a multiple sclerosis syndrome of fifteen years' duration. There were no significant remissions during the seven years previous to the time he was first seen by us. Rapid deterioration had been noted over the previous twelve months following two severe seizures suggestive of apoplexy. In May, and again in December of 1952, the patient experienced sudden dizziness, diplopia, inability to speak, complete paralysis of the right side of the body, marked muscular weakness on the left, and increased bladder symptoms. Since the December attack the patient had been unable to feed himself, shave, or get out of bed without assistance. Locomotion and the maintenance of equilibrium had become increasingly difficult, although he was assisted by two canes and had a brace for the right foot-drop.

Physical examination: The abnormalities were limited almost entirely to the nervous system. There was a mild gingivitis. X-ray examination of the chest revealed no demonstrable organic changes in the lungs. The heart was within normal range for size and configuration. The salient points in the survey were as follows:

1. Urination every fifteen to thirty minutes. No physiologic urge to move bowel; required enemas periodically.

2. Unable to walk or stand without assistance; walking difficult, with two canes used for support.

3. Right upper extremity: Slight atrophy of interosseous muscles, and moderate rigidity. There was ataxia, asteriognosis and loss of position sense; vibratory and pain senses were intact. The hand was claw-like and had no grip; the arm could not be raised above the horizontal, and it tired easily. There was marked weakness of all muscle groups. No Hoffmann's sign; deep reflexes were slightly hyperactive.

4. Right lower extremity: Slight atrophy and marked rigidity of all muscles, with foot drop. Leg held in extension. Motor function almost absent; able to abduct or adduct leg only slightly (4–5 inches) and raise heel off bed 2 inches. Loss of vibratory and position senses: pain sense intact. Spontaneous Babinski, exaggerated on plantar stimulation, causing leg clonus. No patellar clonus; ankle clonus marked; all deep reflexes hyperactive.

5. Left upper extremity: Very slight atrophy of interosseous muscles. Moderate weakness and slight rigidity of all muscle groups. Muscle strength estimated to be 50 per cent of normal. No ataxia, asteriognosis, loss of pain or vibratory senses; position sense lost. Motor function intact. Hoffmann's sign present; deep reflexes very hyperactive compared to those of right upper extremity.

6. Left lower extremity: Slight rigidity on flexion of leg on thigh. Marked-to-moderate weakness of all muscle groups. Muscle strength estimated to be about 35 per cent of normal. Loss of position and vibratory sense; pain sense intact. Spontaneous Babinski, exaggerated on plantar stimulation. No patellar clonus; ankle clonus marked; patellar, suprapatellar and achilles reflexes hyperactive.

7. Trunk muscles: Unable to rise from recumbent position or turn in bed.

8. Abdominal and cremasteric reflexes absent.

9. Coordination: Difficult to evaluate, because of the combination of generalized muscle weakness, rigidity and paralysis.

10. Speech: Rapid, slurred and difficult to understand.

11. Tremor: Very slight and fine, in left hand.

12. Skilled acts: Ability in this respect difficult to evaluate because of the combination of generalized muscle weakness, rigidity and paralysis.

13. Cranial nerves: Ptosis of right eye, with one-third closure. Both pupils were round and reacted to light and accommodation. Right pupil slightly smaller than left. Funduscopy showed bitemporal pallor of the discs, and a vein-to-artery ratio of 4:2; there was slight arteriovenous nicking. Arterioles were slightly tortuous, with widening of reflex stripe. Adjacent to the disc, at 3 o'clock in the right eye and at 9 o'clock in the left eye, was a small wedge-shaped granular area of decreased vascularity with increased pigmentation. No hemorrhages or exudates were seen. There was slight right facial weakness.

CLINICAL RESULTS

The data on blood pressure and weight are summarized in Table 2. No changes in personality were noted at any time.

Improvement was progressive, starting approximately twelve hours after the first intrathecal injection of hydrocortisone. On the fourth day of treatment and before starting ACTH there was obvious improvement in bladder function, speech and muscle strength, with diminishing spasticity and loss of asteriognosis.

During the second week of treatment and persisting up to the day of discharge from the hospital, the following findings were noted:

1. Normal bladder and rectal function.

2. Ability to stand alone. There was no Romberg sign with the eyes open but there was a suggestion of one when the eyes were closed and the head tilted backward.

3. The patient was ambulatory but walking was difficult because of right foot-drop.

4. Right upper extremity: Negligible atrophy of interosseous muscles. No rigidity, ataxia or asteriognosis. Position sense intact. Some persistence of claw-hand; grip fair. Muscle strength about 60 per cent of normal. Able to raise arm above the horizontal. There was a faint Hoffmann sign, and the deep reflexes were slightly increased.

5. Right lower extremity: *Very little change* from pretreatment level. The spontaneous Babinski was no longer present and there was slightly diminished rigidity and spasticity. There was ability to dorsiflex and plantarflex the toes slightly. Most improvement was seen in abducting and adducting the leg when getting in and out of bed. Ankle clonus present but easily exhausted.

6. Left upper extremity: Complete (100 per cent) return of muscle strength. No rigidity. Position sense intact. There was a weak Hoffmann sign. Hyperactivity of the deep reflexes was diminishing.

7. Left lower extremity: No rigidity. Muscle strength about 85 per cent of normal. Deep reflexes slightly hyperactive. Loss of spontaneous Babinski, but plantar stimulation caused dorsiflexion of great toe. When patient was re-

TABLE 2

Blood pressure and weight

Date	March																		April			
	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4
Blood pressure (mm. Hg)	138/100	135/95	130/92	132/98	135/95	125/95	135/105	138/110	135/105	130/100	125/90	128/92	130/95	125/88			120/88	118/85	108/80	112/80	108/82	112/80
Weight. (pounds)	185		184½		183½	183		180		178	179½	180	182	177½	180	177	178	179	179	177½		
Diet	Regular house diet						2000 cal.—salt-free				3000 cal., high prot., mod. fat & carbohyd., salt-free											

cumbent, ankle clonus was easily exhausted. Throughout April 2, 1953, the day following the last intrathecal dose of hydrocortisone, there was no Babinski sign and no ankle clonus. There was no change in the position or vibratory senses.

8. Trunk muscles: Patient able to sit up in bed by holding sides of mattress, to turn over from right to left and from left to right, and to get in and out of bed unassisted though with slight difficulty.

9. Abdominal and cremasteric reflexes: No change except for a transitory left upper abdominal reflex, which was present for one day following the last intrathecal dose of hydrocortisone.

10. Coordination: No evidence of static ataxia, dysmetria, dyssynergia or rebound phenomena.

11. Speech: Improved about 95 per cent.

12. Tremor: No change in left hand.

13. Skilled acts: Patient able to wind small watch with both hands, to use knife to cut meat, to feed himself, and to shave.

14. Cranial nerves: No ptosis. Right pupil the same size as before treatment. Funduscopy: Beginning revascularization of the upper and lower poles of the temporal half of each disc. One-third revascularization on the right and two-thirds on the left. Vein-to-artery ratio 4:3. Wedge-shaped area in retina of each eye showed contraction, with increased vascularity and decreased pigmentation. There was no facial weakness.

LABORATORY RESULTS

Results of *spinal fluid* examination during treatment are summarized in Table 3. There was no laboratory evidence of irritation of the cord or meninges following intrathecal injections of crystals of hydrocortisone, and the spinal fluid colloidal gold reaction reverted toward the normal.

Cholesterol determinations and ultraviolet absorption studies were made on three samples of spinal fluid obtained on different days, ten minutes following subdural administration of hydrocortisone crystals. Although the Lieberman-Burchard reaction did not occur at all in any of the three specimens, indicating the absence of cholesterol, ultraviolet absorption was λ max. at 239 on two specimens obtained March 17 and March 20, 1953. Compound F absorbs with λ max. at 239. The specimen obtained on March 16, following the first subdural dose of hydrocortisone, contained no compound F but revealed an unidentified absorber at λ max. 228. This compound may have been a degradation product of hydrocortisone.

Results of *blood* examination during treatment are summarized in Table 4. A complete blood count on admission showed: RBC, 4.98 million; WBC, 8.7 thousand; Hgb., 94 per cent or 14.7 grams; color index, 0.94; differential—3 eosinophils, 62 polymorphonuclear leukocytes, 34 lymphocytes, and 1 monocyte. A complete blood count on the day before discharge from the hospital showed: RBC, 4.52 million; WBC, 7.55 thousand; Hgb., 89 per cent or 13.9 grams; differential—1 eosinophil, 47 polymorphonuclear leukocytes, and 52 lymphocytes. The coagulation time was 3 minutes, 45 seconds; and bleeding time was 2 minutes,

TABLE 3

Spinal Fluid

	March										April		
	16	17	18	19	20	21	22	23	24	27	1	4	11
Total protein (mg./100 ml.)	20	15	20		20	20		30		20	20	15	15
Glucose (mg./100 ml.)	86	89	75		82	96		80			64	74	80
Sodium (mEq./L)	144		143		142	143				143.5	137	140.9	139.3
Potassium (mEq./L)	3.4		3.1		2.8	2.8				2.8	2.8	3.0	2.7
Chlorides (mEq./L)	125		123		125	124					131	—	123
Calcium (mg./100 ml.)	5.7	4.9				5.7		4.5		5.2	6.4	5.0	5.0
Cells (per cu. mm.)	0		5 lymphs.		6 lymphs.					0		0	0
Quant. Kolmer	Neg.												
Cholesterol	×	×				×	Colorimetric method—no color developed.						
Pressure (cm. H_2O)	110	105	45	0	85	0	0	0	0	85	105	80	93
Colloidal gold		2122332100			1222221100			1111210000		1111100000	1110000000	1110000000	1100000000
Headache	0	+	+	+	0	+	+	+	+	0	0	0	0

TABLE 4
Blood

	March											April		
	16	17	18	20	21	22	23	24	25	27	30	1	4	11
Potassium (mEq./L)	5.1		4.5	3.5	4.3		4.7		4.1	4.8	3.7	4.5	4.5	4.2
Sodium (mEq./L)	140.7		139.4	140	140		142		143.2	135.5	138.9	139.1	136.9	137.8
Chlorides (mEq./L)	107			110	106				106	104	105	108	103	107
Tot. protein (Gm./100 ml.)	6.2		5.4	5.9	6.1		6.0		5.9	6.0	5.8	5.8	5.2	5.5
Albumin (Gm./100 ml.)	3.1		2.9	3.2	3.4		3.3		3.3	3.0	3.4	3.3	3.0	3.2
Globulin (Gm./100 ml.)	3.1		2.5	2.7	2.7		2.7		2.6	3.0	2.4	2.5	2.2	2.3
A/G ratio	1		1.2	1.2	1.3		1.2		1.3	1.0	1.4	1.3	1.4	1.4
B.U.N. (mg./100 ml.)	12.5			8.4					13.7	19.0	12.6	14.1	12.1	9.6
N.P.N. (mg./100 ml.)	35.4			32.7					39.9	45.9	42.6	40.8	40.2	35.0
Glucose (mg./100 ml.)	118		139	107	89		111		93	100	100	100	109	107
Cephalin flocculation				×	—Neg. in 24 and 48 hours									
Free cholesterol (mg./100 ml.)	25		8		10		15		19		20	20	26	
Tot. cholesterol (mg./100 ml.)	120		147		150		132		118	92	120	117	114	
Ester'd cholesterol (mg./100 ml.)	95		139		140		117		99	71	100	97	88	
Calcium (mg./100 ml.)	10.7		11	10.3	10.4		10.4		10.4	9.8		11.2	9.8	9.2

10 seconds. These tests were made on the fourth day of intrathecal hydrocortisone and before starting ACTH.

Urinalysis was performed on 24-hour daily urine specimens, on admission and throughout the hospital stay. The urine was clear and acid; the specific gravity was around 1.021; there was no albumin, glucose or acetone. Microscopic examination revealed a few epithelial cells. A Sulkowitch calcium turbidity test on daily specimens gave results which were within normal range. Urinary output was consistent with fluid intake.

Serum protein and cholesterol levels: Early in the course of therapy there was a slight but steady rise in the concentration of total serum protein and the total serum cholesterol fractions. The rise in the esterified serum cholesterol level was most prominent.

Since the dosage of ACTH was being increased and the patient's improvement appeared stationary at the time the foregoing findings were noted, corticogenic hypothyroidism was suggested. Oral *l*-thyroxine-sodium was started and this therapy was followed by a steady lowering of the serum total protein and total cholesterol levels, associated with clinical improvement. Although the serum total protein and the total cholesterol concentrations varied, there was a steady improvement in the albumin-globulin ratio and the cholesterol-ester:free cholesterol ratio.

Serum sodium, potassium, chlorides, glucose and calcium levels showed minor changes, and that of non-protein nitrogen remained slightly elevated.

FOLLOW-UP STUDIES

The patient was seen weekly in the Out-patient Department for six weeks. The spinal fluid colloidal-gold reaction on May 2, 1953, was 1-1-2-2-2-0-0-0-0-0. At the time of writing, there was no evidence of regression or relapse.

Addendum

Since this paper was submitted for publication, 2 additional patients have been studied and the results are considered similar to those obtained in the case herein described.

Acknowledgment

We wish to thank the Schering Corporation and Dr. Edward Henderson, their Director of Clinical Investigation, for interest and financial aid in making this work possible.

AGING SKIN

With Particular Reference to Small Growths Appearing Late in Life*

EUGENE F. TRAUB, M.D.† and HERBERT J. SPOOR, M.D.

Department of Dermatology, New York Medical College, New York, N. Y.

Simple comparison in size between the major enterprise that is the cosmetic industry, and the minor subspecialty of medicine that is dermatology, will do more than my words to emphasize that the so-called beauticians, or cosmeticians have been far more interested in the skin than have physicians. Of particular import to cosmeticians and their customers, are the changes which occur in the skin and appendages with advancing age. Remedies without number have been sold for the removal of wrinkles, roughness, blemishes or dryness. The implication that use of the particular product will prevent or reverse these changes—which we as physicians attribute to senile atrophy—is the subject matter of much cosmetic promotion. By the same token, the public is constantly asked to try all sorts of hair tonics, hair restorers and color replacements. If reason did not prevail, one would be inclined to believe that, here too, an aging process was being altered by external means. The truth is, of course, that these cosmetic products and the many more like them are for decorative purposes only and, today at any rate, that is as far as the unvarnished facts will stretch.

Let us say this for the industry, however; practically the only real investigations directed toward understanding any of the factors underlying the process of skin aging have been either sponsored by the cosmetic groups or accomplished by investigators in their employ. We physicians have very little to boast about when we question our own knowledge of what actually happens as the integument ages. We have a little knowledge gained through research on the cyclic progression of hair growth (1), but what controls the life of the hair papillae, why does fringe hair remain on the scalp while the central hair is lost, what is responsible for color changes in the hair, and why do some individuals lose hair while others do not, remain completely unanswered questions. We can take small comfort from knowing that we can recognize practically any dermatologic entity, both clinically and microscopically (2); we still understand very little of why wrinkles and other progressive atrophic changes of the skin occur, and whether or not keratoses and cutaneous malignancies are inevitable or preventable.

Senile Atrophy

Probably the most important change, and possibly the common denominator of most changes in the skin, is the gradual general process known as senile

Received for publication May 28, 1953.

* Presented at the Annual Meeting of the American Geriatrics Society, New York, May 28-30, 1953.

† Address: 140 East 54th St., New York.

atrophy. Our specific dermatologic interest in senile atrophy, namely the precancerous dermatoses, will be discussed subsequently; at this juncture, let us consider what is known of the general subject. Senile atrophy of the skin usually starts soon after the age of 40 (3). The epidermis becomes thinner and the outermost horny layer appears looser. Multiplication by mitoses in the basal layer becomes less frequent, and the cells of both the basal layer and the prickle layer begin to show vacuolization. Gradually the papillae flatten and lose elastic fibers. The collagenous fibers grow thinner. The elastic fibers in the cutis show clumping, shortening, thickening and, at times, irregular hyperplasia which accounts for some of the yellowish thickened folds of the aging face and neck. The true regulator of facial elasticity, the *elastica mimica* begins at puberty, reaches its highest development at 30, begins to regress at 40 and vanishes at 60. Other than the changes in elasticity, changes undergone by the sebaceous glands and other appendages are important. The sebaceous glands become much reduced in number, except for those of the nose and forehead, which show hyperplasia after the age of 40. The hair follicles become reduced in numbers and those which remain are often without hair. The piloerector muscles become atrophic. With regard to nonspecific skin structures—the subcutaneous fat shows degeneration, the general water content is reduced, capillary response to stimuli slows down and there is a general decreased sensitivity to touch, pain and temperature change. Sensitivity to cold in the aged is a vascular change, rather than a property of the skin.

Actually, for a classification of the cutaneous manifestations of aging we are dependent upon the cosmetician's observations, namely, the type and distribution of wrinkles and other external signs of change. Classically, the skin passes through the following chronologic stages:—

Age (yrs.)	Condition of skin
20-	Facial skin is still free of wrinkles. Cheeks are rounded, so that mouth and nose appear small.
25-	Forehead and lower lids show the first wrinkles. Nasolabial fold becomes apparent. Veins on back of hand begin to show.
30-	"Crow's feet" appear at the lateral angles of the eyes. (Beard growth heaviest between the ages of 30 and 40.)
35-	First folds appear in front of the ears (preauricular wrinkling). Hair begins to turn grey. Cheeks change from rosy to ruddy.
40-	First signs of the wrinkles which are going to occur are now present. Preauricular and cervical folds are evident in proper light.
45-	Suborbital wrinkles and double chins appear; the lips become thinner and the eyebrows bushy.
50-	Hands become wrinkled, and small wrinkles appear on bulge of nose, ear lobes and chin. Entire skin is relatively dry.
55-	Senile hyperpigmentation starts. Folds form at nape of neck (elastic tissue hypertrophy).
60-	Teeth appear longer, because of atrophy of alveolar ridge. There are radial wrinkles around the mouth. The cheeks are loose and droopy.

65- Hair grows in ear canals, nostrils and nape of neck, in both male and female. There is bristly hypertrichosis on the chin area in the female.

70- Wrinkles crease over each other to form nets (*papyraceous wrinkling*). Scalp hair is thin or absent. Senile pigmentation has increased.

75- Lips are thin, to the point of having no vermilion border. Backs of hands are wrinkled like thin paper.

80- Tired expression of eyes caused by drooping eyelids (senile ptosis). Ears large and flabby. The underlying fat of the skin is gone, so that the overall impression is boniness.

Senile Dermatoses

The onset of old age predisposes to a great number of dermatoses (4). With the 40's and 50's begin the "involutional" dermatoses, in which focal and chronic systemic infections interact with allergic states and local irritants to produce the intractable "eczemas." The neurogenic factor increases steadily in significance, and there may be systemic complications such as obesity, diabetes, arteriosclerosis and dietary deficiencies to add to the cutaneous senile changes (atrophy, hyposecretion and precancerous lesions). The specific dermatoses of the older age groups are the keratoses, epitheliomas, pigmented spots, senile angiomas, xanthelasmas of the eyelids, sebaceous adenomas and pedunculated fibromas. More generalized lesions are the dry-skin syndromes produced by reduction in sebaceous activity; these lead to very stubborn senile pruritis and purpura. The skin and its underlying vascular bed are readily injured; thus senile telangiectatic and purpuric spots appear almost spontaneously and, on resolution, leave residual pigmentation.

Keratoses

From our standpoint as dermatologists, the most important of these senile atrophic changes of the skin is that which gives rise to the keratoses, the Bowenoid changes, the acanthomas and the cutaneous malignancies. This change comes about gradually and without any discomfort, despite the fact that the skin becomes very dry, loses its previous elasticity and may undergo various color alterations. These color changes are of great interest. The skin may assume a pale grayish color; or there may be a mild erythema, with varying degrees of telangiectasis giving the face a flushed reddish color; or hyperpigmented areas, with or without scaling, may alternate with depigmented spots. All these changes are tempered by the degree of active wind-and-weather exposure during the subject's lifetime. The picture has been termed "farmer's" or "sailor's" skin. There is no fixed age at which time these alterations may have become moderately or even well developed. It was once thought that fair-haired individuals, *i.e.*, blondes or red-heads, were the most susceptible to these changes but it appears that eye coloring is even more significant. Blue-eyed individuals, whether blondes or brunettes, more readily acquire this harshness, dryness and premature atrophy, with its tendency to freckling on the exposed surfaces of the face, neck, arms and hands.

Histologically, there is a general thinning of the epidermis, with a flattening

of the papillae and an increase in the amount of pigment in the basal-cell layer. There is evidence of colloid degeneration of the elastic fibers, which may be irregular, swollen and grouped in bundles; and the collagenous tissue may be atrophic. Whether the lack of pigment in the skin of the Caucasian race favors these changes, is a question which has not been settled, but it is of interest to note that cutaneous cancer is relatively infrequently seen in Negroes.

Several types of keratoses are prone to develop on this atrophic skin:

1. *Senile keratosis* (keratoma senilis) is found chiefly on the parts of the skin exposed to the elements—the face, neck, arms and backs of the hands. According to Ormsby and Montgomery (5), from 20 to 25 per cent of these lesions terminate as prickle-cell epitheliomas, and only infrequently as basal cell epitheliomas. Bowenoid cells may be found in the epidermis before frank epitheliomatous changes occur.

2. *Seborrheic keratosis* (seborrheic verruca) may occur on the scalp and exposed parts but is a condition found more commonly on the trunk, especially under the breasts in women. The seborrheic keratoses are not prone to cancer development and only about 2 to 3 per cent of these lesions are said to undergo malignant change. In our personal experience the incidence has been even less. One must be certain of the origin of the cancerous lesion before assigning to a benign senile change a role as a precursor of cancer. In a recent patient, a large keratosis was removed and the diagnosis of seborrheic verruca microscopically confirmed. About six months later, the same patient returned with an inflamed and irritated cancerous tumor on the back, located about 5 inches from the previous growth. The first thought was that here was a seborrheic keratosis that had become malignant; but on careful questioning it was definitely brought out that the last lesion had developed suddenly, in less than six weeks, and on a smooth area of skin where there had been no pre-existing growth. This case is cited only to show how easy it would have been to assume a transitional lesion, rather than a newly developed one.

Cancer

Since cutaneous cancer accounts for approximately 40 to 60 per cent of all types of malignancy seen by the family physician, and since skin cancer recognized early and treated adequately is 100 per cent curable, a number of important diagnostic and therapeutic points should be made here. First, early recognition is just as important in dealing with cutaneous cancer as it is with internal cancer. In the second place, although skin cancers can be cured by the expert comparatively easily, it is most distressing to find that a large number of patients are not cured by the first or even by many repeated treatments given by physicians who unfortunately possess little or no skill in this type of work. Such carelessness results in an annual death rate from skin cancer of more than 3,000 persons. This figure could be reduced almost to zero, even though the notorious malignant melanoma is a most vicious killer. The third point is that a great deal can be done prophylactically. Atrophic, dry senile skin should be oiled or greased with some suitable preparation every day. Animal fats are

usually better for this purpose than are vegetable or mineral oils, but of course one must remember that some individuals react unfavorably to even lanolin. In addition, all exposed parts of the body should be given especial protection against sun, wind and weather generally. Sun-screen remedies should be used routinely. Certain medicated creams containing oxygen, if used regularly, seem to hold in check the development of the senile keratoses. Large frequently repeated doses of crude liver extract also seem to have some beneficial effect. We have repeatedly observed that in cases of multiple basal-cell epithelioma additional growths seem to develop much less frequently when the patients are receiving liver injections. Research along these lines might be truly fruitful.

Unfortunately, time will not permit a detailed description of all of the types of change seen in early or late malignancy of the skin. Suffice it to say that all tumors of the skin that appear suddenly and grow rapidly should be seen immediately by a competent dermatologist. Also all growths of long standing, though they grow ever so slowly, and growths which ulcerate though they be painless, should receive attention. Even the smallest of these lesions should be subjected to biopsy, regardless of the elected mode of treatment. Clinical diagnosis is very accurate, but microscopic confirmation in the case of a presumptive malignant lesion, is sound practice.

Angioma

We doubt if there is any special significance to senile angioma, but in any case it certainly does not have the serious prognostic import for liver damage that has occasionally been ascribed to it. These tiny red spots may appear on any part of the body, but most commonly they appear on the trunk, and make themselves visible with increasing frequency after the age of 40. They probably represent a local degenerative change of the vasculature.

Xanthelasma

Xanthelasmas are yellowish-to-orange colored plaques that occur on or about the eyelids. As a disorder of cholesterol metabolism these lesions have received considerable study. It has been shown that diet has no effect upon them and they must be removed manually if one wishes to be free of their cosmetic nuisance. Again it is good medicine to assure oneself that the patient does not have a systemic cholesterol disturbance, or latent cardiovascular disease. The mere existence of xanthelasma is not prognostic of coronary artery disease, as has been implied by some.

SUMMARY

The problem of the aging skin has been discussed, not entirely from the standpoint of dermatologic recognition and treatment of the existing lesion, but more from the standpoint of showing how little we know about what causes the skin to age. It is imperative that we as physicians undertake much more basic research, in order properly to understand and treat the conditions which belong in this category of geriatric medicine.

REFERENCES

1. McCarthy, Lee: Diagnosis and Treatment of Diseases of the Hair. St. Louis, C. V. Mosby, 1940.
2. Lever, Walter F.: Histopathology of the Skin. Philadelphia, J. B. Lippincott, 1949.
3. Weiner, Kurt: Skin Manifestations of Internal Disorders. St. Louis, C. V. Mosby, 1947.
4. Stokes, John H.: Fundamentals of Medical Dermatology. Philadelphia, Univ. of Pennsylvania Press, 1939.
5. Ormsby, O., and Montgomery, H.: Diseases of the Skin. Philadelphia, Lea and Febiger, 1945.